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John K. Thum, Ph. M. Arno Viehoever, Ph. D. E. Fullerton Cook, Ph. M.
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THE AMERICAN
JOURNAL OF PHARMACY

VOL. 101 JUNE, 1929 No. 6

EDITORIAL

COMMENCEMENT

"THERE IS NO dead-line of achievement—but it pays to start young."

And June is the month when young America starts—commences.

All over the land, the academic flood gates are opened wide with June, and youth pours out to irrigate the world with wisdom. Ground fine in the mills of the pedagogue, steeped in the tenuous learning of books and percolated through and through with the solvent flow of classroom technique, this saturated essence, alive in active principles, now flows out to serve its several purposes.

Arid wastes await it—hidden seedlings in the sand crave its blessed touch and parched green things perk up to offer welcome to its gay caresses.

. . .

Yet it is said that before the world can safely use this fluid force, it must suffer great attenuation. And suffer it will before it serves. The learning of books must be unlearned, and the rain of experience must drizzle long before youth's corrosive ions will yield to useful dilution.

Said the cynical old doctor—"For five years after my graduation I still believed in all I had read in books and in all that my instructors had taught me. For the next ten years I discounted my teachers' learning, but still had faith in books—but *now* I have lost that faith as well—and *now* I have commenced to serve my people."

Still, it is to be noted that youth for all its exuberance and misplaced emphasis—has served and served well in the work of the world. Did you ever know that—

> Martin Luther was twenty-nine when he wrote the manifesto that led to the Reformation.

John Calvin was twenty-six when he wrote "The Institutes of Theology."

Patrick Henry was twenty-seven when he made his speech against the Stamp Act.

Thomas Jefferson was thirty-three when he drafted the Declaration of Independence.

Alexander Hamilton was aide-de-camp of Washington at twenty, and at thirty-two first Secretary of the Treasury.

Napoleon was twenty-seven when he was appointed to the command of the Army of Italy, and thirty-five when he crowned himself Emperor of the French.

Alexander had conquered the known world, though not himself, and was dead at thirty.

Charlemagne was master of France and Germany at thirty.

James Fox was Lord of the Admiralty and a thorn in the side of George III at twenty-one.

William Pitt became Chancellor of the Exchequer at twenty-three, and Prime Minister at twenty-four.

Charles Dickens was twenty-four when he began "Pickwick Papers" and twenty-five when he wrote "Oliver Twist."

Poe was doing some of his best work at twenty-five.

Balzac wrote seventy-nine novels between the ages of thirty and forty-three.

James Bryce had written "The Holy Roman Empire" at twenty-six.

Benjamin Franklin had written "Poor Richard's Almanac" at the same age.

David Hume at twenty-six had shocked all Christendom with his highly heretical "Treatise on Human Nature."

Ruskin wrote "Modern Painters" at twenty-four.

Stevenson had completed "Treasure Island" at thirty-three.

Keats, Shelley, and Byron were dead at twenty-five, thirty, and thirty-six, respectively.

Sheridan wrote "The School for Scandal" at twenty-seven.

Shakespeare had completed ten of his greatest plays at thirty-two.

Newton formulated the law of gravitation at twenty-four.

McCormick and Westinghouse were twenty-three when they invented the reaper and airbrake.

Michelangelo did his statue of David at twenty-six.

Carnegie was an iron-master in his twenties.

Rockefeller was rich before he was thirty.

and so we might go on—and on.

So, too, might we show the other side of the picture.

For instance, there is Henry Ford—who, at forty, was a hard-working mechanic known to his neighbors as a queer crank. Ten years later his bouncing bet was America's pet contrivance.

George Eliot wrote *her* first novel when she was close to forty and Conrad was over fifty before his genius was recognized.

William de Morgan, author of Joseph Vance, was over sixty when his famous novel appeared.

And so we might say that to success, too, there is a relativity—

Out of the rich warm soil of youth genius may as freely sprout as from the mellow loam of later life. And, again, we say that "There is no dead-line of achievement—but it pays to start young."

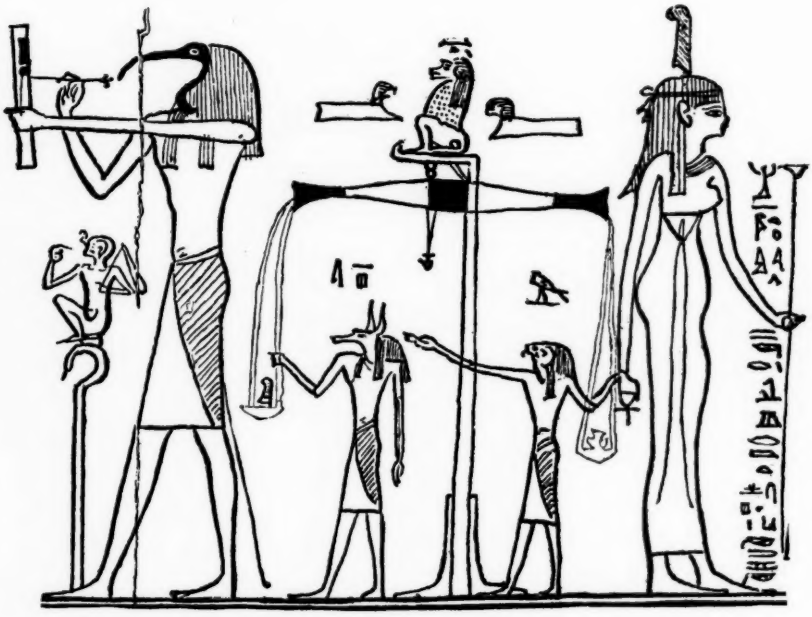
IVOR GRIFFITH.

THE FIRST BALANCE AGAIN

THE EDITOR of this Journal discussed briefly in the May issue the question as to the origin of the balance, moved to that thought by perusal of Professor Nichols' interesting and comprehensive lecture appearing in the same issue. Endeavoring to trace the origins of human customs, language, weapons, household articles and the thousand and one other things that go to secure human happiness or cause human misery, is a fascinating, but generally hopeless, task. Sydney Smith spoke of "those confounded ancients who anticipated everybody." The recent excavations in the near East have shown a high development in many arts and even in some applications of science at early periods.

To return, however, to the question of the first balance it will be interesting to present a picture taken from the Egyptian "Book of the Dead." This is a work that has been found in tombs in many places in Egypt, and dates back to a remote past, though, of course,

within the period of high civilization. Many fragmentary papyrus manuscripts of it are in museums, and also a few extended texts. Numerous illustrations, of the peculiar Egyptian type, are included. The most striking is a large picture in much detail showing the Judgment of Osiris. . . . As part of the procedure, the heart of the deceased is weighed against a figure bearing a feather (the latter the



From a Facsimile of the Turin Papyrus.

symbol of truth). The ibex-headed god Thoth, who is the recorder of Court, notes the finding. A figure stands to the right of the balance, apparently a sort of usher. The soul of the deceased is not shown, as the cut was made from a large sheet and only the portion important in this connection was chosen.

HENRY LEFFMANN.

ORIGINAL ARTICLES

SNAKES AND SNAKE PROTECTION*†

By Louis Gershenfeld, Ph. M., B. Sc., P. D.

Professor of Bacteriology and Hygiene, Philadelphia College of Pharmacy and Science

JUST AS THE term bacteria frequently inspires terror in many individuals so does the term snakes bring awe and fear to many thinking and reasoning humans; and just as most members of the former class are harmless and some useful, so among the snakes are most of them harmless, and in fact, many are friends of agriculture. To-day they even find an extensive use in commerce. Why is it that humans and almost all animals become panic-struck at the sight of a snake and seem at once deprived of all their powers, including that of motion? Why should there exist such a fear and dread, and even an obsession against snakes? Why should the popular attitude (of adults) towards snakes be hostile? Why does the mentioning of snakes (even in name only) create such an antipathy and disgust? Occasionally a plausible excuse is available but in many instances, the whys and wherefores are unexplained. For the average individual a snake is a snake and for the more intelligent they fall into two divisions, those which are poisonous, and snakes which are harmless. In a way such a classification may be satisfactory, but a grouping as this tends to leave the impression that the poisonous snakes form one distinct group and the non-poisonous snakes form another group, both being unrelated. This is far from the actual facts, and as we will see, both arise from a common stock.

Louis Gershenfeld, Ph. M., B. Sc., P. D.

Snakes belong to the Class of Reptiles. Now the Class Reptilia consists of many Orders. Let us first get a bird's eye view of the subject involved and the relationship of snakes to other members in this class. The classification which follows is a very brief outline:

*To be concluded in the July issue.

†One of a Series of Popular Science Lectures given at the Philadelphia College of Pharmacy and Science.

CLASS REPTILIA I. Rhynchocephalia—This is represented by one single species, the curious Sphenodon, inhabiting New Zealand and the last remnant of an Order once widespread and abundant and now extinct. Lizard-like in form, it differs in skeleton and anatomy from all other living reptiles.

II. Chelonia—Turtles and Tortoises found here are enclosed in a bony shell. They are generally distributed throughout temperate and tropical areas, the former being semi-aquatic and marine and the latter terrestrial.

III. Crocodilia—The Crocodilians—Crocodiles, alligators and the South American caymans. These differ from other reptiles mainly in the fact that there is a muscular diaphragm between the thoracic and abdominal cavities and the ventricle of the heart is completely divided. They are mainly semi-aquatic and generally found in tropical and semi-tropical regions.

IV. Lacertilia—The Lizards. In the latter the ventricle is undivided with the presence of the typical reptilian heart; there is no shell about the body; the branches or rami of the lower jaw are united by suture and they possess paired copulatory organs. There are nearly 2600 species of lizards only two of which are poisonous, the latter being the Gila Monster found in the desert regions of Southern Arizona and New Mexico (the valleys of the Gila River and its tributaries) and the Mexican Beaded Lizard ("Escorpion") found in Central and Western Mexico to Northern Central America. These two poisonous species of lizards have fangs on the lower jawbones.

Lizards are found but infrequently in temperate climates and are usually general throughout tropical and semi-tropical areas. They may be terrestrial (ground or on land); subterraneous (burrowing or underground); arboreal (on trees) or semi-aquatic. There is an array of varied forms differing widely in size, structure, habits, etc. The typical lizard possesses a scaly coat, characteristic for each species, and usually four developed limbs. A tapering tail used mainly for purposes of defense, a peculiar and characteristic arrangement of teeth and as a rule functional eyelids are present. In some species of lizards where the limbs and scales have disappeared and these reptiles, gliding along like snakes, resemble the latter, the presence of the functional eyelids is an important means of distinguishing them from the snakes. There are no snakes which would be mistaken for lizards but there are lizards which many observers may mistake for snakes.

V. Ophidia—The Snakes. The branches or rami of the lower jaw in the latter are united by a ligament and not by suture. Approxi-

mately two thousand species of snakes have been classified. With the exception of the Arctic and Antarctic regions, snakes are found almost everywhere. They are far more abundant in the temperate zone than the lizards. Some of them, especially these days, are of value to man. Most of them are valueless. About one-quarter of all species are harmful, in fact many of these are dangerous and even fatal, and it is these snakes which it is well to recognize when encountered. Due to their habits, and especially during feeding when they seek seclusion so as to assimilate food, snakes are not commonly observed in as large numbers as actually present. Variations in size and structure are more marked among snakes than among the other reptiles. We have on the one hand species of burrowing snakes, but 4 to 6 inches in length, with the thickness of a goose quill, and on the other hand, there are species of the Python, from 20 to 30 feet, or the Anaconda, monarch of the Boas, credited with a length of 40 feet and higher with a proportionate girth.

Differences between True Snakes and legless lizards are not at times very marked. The chief points involve the bones of the head, in particular those of the lower jaw. Among lizards, the lower jaw is single—among snakes, the lower jaw is composed of two elongated, almost straight bones, connected in the front merely by an elastic ligament. There is also a much greater elasticity present, enabling a snake to engulf its prey entire. In the swallowing performance and the anatomy of those parts concerned therein, we find a marked difference between snakes and lizards. Another important characteristic as mentioned is the absence of eyelids. There is an assortment of species of snakes—some stout, others excessively slender, terrestrial, arboreal, subterraneous or aquatic in habits, their patterns embracing an amazing display of designs and hues. The classification of the Ophidians is a task attended with great difficulty. In classifying the snakes, the scales, rows of scales, structure of head shields, number of abdominal plates, and in particular, the dentition are carefully noted and employed as important aids.

BIBLICAL REFERENCES AND DERIVATION OF NAMES, REFERRING TO SNAKES

You will observe from the brief outline given that a snake is a reptile but not all reptiles are snakes. All Ophidians are snakes and in like manner the scientific names of the various divisions, which will be mentioned, are finding their way into our everyday language. These refer to specific groups of snakes. But there are several

other names that have come down to us from the Bible and literature which are as we may regard them synonyms for snakes. The science dealing with the study of reptiles is known as herpetology. The word "Reptiles" is derived from the latin, reptilia, creeping things. The term reptile is frequently employed as an adjective to describe a human whose qualities are contemptible, sneaky and malignant. The origin of the word "Snake" is uncertain. The term "Serpent," which is used even more frequently and is practically synonymous with "Snake," is derived from the word serpere, meaning to creep. It is this word which is employed in an allegorical sense when referring to a subtle and dangerously fascinating person.

There are several Hebrew words which indicate forms of serpents and which are variously translated. Some of these ("Tzepha," "Akshub," "Pethen" and "Shephiphon") and their translations will be considered later. Then we hear of "Epheh," which is usually translated as "Viper." "Nachash" refers generally to any kind of a serpent, while "Tannin," though translated as serpent in Exodus, 7:9, is more frequently rendered "dragon" or "sea-monster," as in Genesis, 1:21, and Job, 7:12. The word "Saraph" as found in Numbers, 21:6, and Deuteronomy, 8:15, is translated as "fiery serpents," but there is nothing to indicate what this refers to. The following Biblical references to the serpent are to be found:

Genesis, 3:1, 2, 4, 13, 14, 15: "The serpent more subtil than any beast of the field deceiveth Eve and is finally cursed by God." The story of the snake tempting Eve is handed down by all religions and all people accordingly seem to feel that this reptile possesses some peculiar virtues though it is more than likely of a purely superstitious origin.

Genesis, 49:17, "Dan shall be a serpent in (by) the way."

Numbers, 21:9, "A serpent of brass was made by Moses, as ordered by God."

II Kings, 18:4, "Hoshea, son of Elah king of Israel, broke in pieces the brasen serpent that Moses had made."

Isaiah, 14:29, Serpent's root, basilisk (cockatrice) and flying serpent are all to be found mentioned here.

Isaiah, 27:1, and 65:25, where in the glory of the restored nation, mention is made "and dust shall be the serpent's food."

Amos, 5:19, "and a serpent bit him."

Micah, 7:17, "They shall lick the dust like a serpent."

Psalms, 58: 4, David, in reproving the wicked judges, says, "their poison (venom) is like the poison (venom) of a serpent."

Psalms, 140: 3, David, in praying to be delivered from Saul and Doeg, speaks of the evil man and the violent man, and says, "They have sharpened their tongues like a serpent; adders' poison (vipers' venom) is under their lips."

Proverbs, 23: 32, in speaking of wine, says, "at the last it biteth like a serpent and stingeth like an adder (basilisk)."

Proverbs, 30: 19, in Agur's confession of his faith, he mentions four things which are hard to be known, and one of these is "the way of a serpent upon a rock." It is probable that this refers to the gliding motion of a snake when progressing.

Job, 26: 13, Job, in reproving the uncharitable spirit of Bildad and acknowledging the power of God to be unsearchable, says, "His hand hath formed (created) the crooked serpent."

Ecclesiastes, 10: 8, "and whoso breaketh through a fence, a serpent shall bite him."

In the New Testament, the following references to "serpent" are made:

St. Matthew, 7: 10, the question is asked what man will give his son a stone if he asks for bread "or if he ask a fish, will he give him a serpent"? 10:16, in giving the apostles their charge, they are comforted against persecutions and it is here where we hear the oft-repeated phrase, "Be ye therefore wise as serpents." It is probable that the wisdom and subtlety ascribed to the serpent arises from the cunning with which it avoids dangers.

A similar quotation is found in St. Luke, 11: 11.

St. Mark, 16: 18, in sending forth the apostles to preach the gospel, they are instructed in the signs which shall follow them that believe and one is, "They shall take up serpents and if they drink any deadly thing, it shall not hurt them."

St. John, 3: 14, "and as Moses lifted up the serpent in the wilderness."

I Corinthians, 10: 9, "and were destroyed of serpents."

II Corinthians, 11: 3, reference is made to the fact that "the serpent beguiled Eve through his subtilty."

Revelation, 12: 9 and 20: 2, "That old serpent, called (which is) the Devil."

The Hebrew word "Tzepha" is translated by some as "basilisk" and by others as "cockatrice." It is variously regarded as a kind of

serpent, lizard, or dragon, though in most cases it evidently refers to some venomous snake. In olden days such a serpent was supposed to be able to "look people dead."

The Cockatrice is a fabulous serpent or serpent-like monster anciently believed to be hatched from a cock's egg. It is often simply another name for the basilisk. Other than those already given, Biblical references to this term, though basilisk is also given as the translation, are to be found in: Isaiah, 14:29, and Jeremiah, 8:17. The basilisks are scientifically to be found in the genus Basiliscus, family Iguanidæ, order Lacertilia (lizards).

The term viper is the translation of the Hebrew word "Epheh." Biblical references other than mentioned are to be found in Job, 20:16: "He shall suck the poison of asps; the viper's tongue shall slay him." In the new testament in St. Matthew, 3:7, John the Baptist reprehends the Pharisees and Sadducees and "he said unto them, 'O, generation of vipers'"; and in Acts, 28:3, Paul suffers shipwreck but lands safe on the Island Malta, is kindly entertained by the "barbarous people" and when gathering sticks and laying them on the fire "there came a viper out of the heat, and fastened on his hand." This viper was probably the Mediterranean viper (Vipera aspis), which though not to be found at present in Malta, occurs in many of the Mediterranean islands.

Several distinct Hebrew words are translated as "adder." In all, the idea conveyed seems to be that of some form of venomous snake. It is employed as a colloquial name for several poisonous snakes mostly belonging to the family Viperidæ, such as the Copperhead, Mocassin, etc., and also for certain harmless snakes of the family Colubridæ, particularly the spreading adder (Heterodon platyrhinus), which when angry resembles the poisonous snakes. In England the name denotes the only venomous snake of Great Britain—the European viper (Pelias berus). The Hebrew word pethen, translated elsewhere as asp, is spoken of as the adder in Psalms, 58:4 (where in speaking of the wicked, it is said "their poison (or venom) is like the poison (or venom) of a serpent; they are like the deaf adder (or asp) that stoppeth her ear."). This probably points to the Egyptian cobra (Naja haje)—for continuing in paragraph 5, we hear "which will not hearken (or hearkeneth not) to the voice of charmers." Another word "Shephiphon," translated as the adder, though given by others as the "horned snake," is to be found in Genesis, 49:17, when Jacob, speaking of Dan, says, "Dan shall be a serpent by (or in) the

way, an adder (or horned snake) in the path." This refers probably to the well-known horned snake Cerastes hasselquistii common in Egypt. The word "Akshub," found in Psalms, 140: 3, when speaking of the evil man and violent man, says, "adder's poison (or viper's venom) is under their lips," is translated as adder, though others apply this term to various poisonous snakes (vipers). In the New Testament, Romans, 3: 13, the same word is translated by asp. The word "Tziphoni," found in Proverbs, 23: 32, when speaking of wine, says, "at last it biteth like a serpent, and stingeth like an adder" is rendered as "adder" and "basilisk" or "cockatrice" by others.

The Hebrew word "pethen," though translated by some as adder, is most frequently translated as asp. The asp is a venomous snake. The name as applied in the Bible refers probably to the hooded or African cobra (Naja haje), common in Egypt and often represented in hieroglyphics. The ancient Egyptians were led to believe that the Asps were the guardians of the spots they inhabited. The figure of this reptile was accordingly adopted by them as an emblem of the protecting genius of the world. References in the Bible may be found in Deuteronomy, 32: 33, "their wine is the poison of dragons (venom of serpents), and the cruel venom (poison) of asps"; Isaiah, 11: 8, "and the sucking child shall play on the hole of the asp, and the weaned child shall put his hand on the cockatrice (basilisk's) den"; Job, 20: 14, "yet his meat (food) in his bowels is turned, it is the gall of the asps within him"; Job, 20: 16, "he shall suck the poison of asps, the viper's tongue shall slay him," and in the New Testament, Romans, 3: 13, in speaking of the Jews' prerogative, the statement is made that "there is none that doeth good, no, not one," and later on "the poison of asps is under their lips."

LITERARY AND OTHER REFERENCES

It would be a long and tiresome task to trace the serpent as it figured in our early history and literature. It would be an ambitious task for an interesting piece of library research. The snake or serpent as we find it came into our literature as the snake of the Bible, a thoroughly despicable creature and that to a great extent, this type was not modified except in few instances where the scientific trend may have correctly influenced the literary mind. The snake appears in every literary form—poetry, prose and ballad, and in the drama. The sum total of the analyses of the snakes' various roles is a tale of hypnotic influences, subtleness, danger and hate. Instances (other than scien-

tific) in which the snake is favorably treated are few in number and to locate them would be like trying to find a quinine pill in a barrel of camphor balls.

The subtlety of the serpent is commended by Aristotle and several naturalists. John Milton, in his "Paradise Lost," mentions the serpent as being selected for the instrument to tempt Eve and speaks of "the serpent subtlest beast of all the field" and the "wily adder." History during the days of Moses relates several interesting references to the ancient magicians and what they did with their serpents. The Psylli or ancient serpent-tamers are mentioned in several writings. Savary gives an account of the modern serpent-tamers in his "Letters on Egypt." The most wonderful of Shakespeare's historical plays, the one in which he has followed history so minutely, is the tragedy of Antony and Cleopatra, in which Cleopatra as tradition has it, determines to follow Antony to a speedy death and perishes by the bite of an Asp secretly brought to her in a basket of figs. There are several fables and fairy stories in which individuals are portrayed as possessing traits of serpents. These stories are not based on any well-ascertained physiological fact. They are merely speculative fancies as is to be found in Melusina, the fairy, who for some offense was changed from her waist downward every Saturday to a serpent. Then there is Keats' "Lamia," a most beautiful poem in which an imaginary being is the subject of magical transformation into a serpent. In Coleridge's "Christabel," Geraldine is referred to as a malignant witch-woman with the evil eye but with no absolute Ophidian relationship. The idea conveyed is of course mythological and not in any sense physiological. Yet in this connection it is interesting to note that just last month in our own city a contest in a half million dollar will was started in which the relatives claim that the testatrix complained of being "pursued and haunted by a man with snake eyes." These relatives were ignored in the disposal of the estate in favor of this "man with snake eyes."

With the exception of the legend of Eve, the snake story of literature was written by Oliver Wendell Holmes, author of the "Autocrat of the Breakfast Table." This snake story first wearing the title of the "Professor's Story," was later changed and is now known as "Elsie Venner." Elsie Venner, a girl poisoned by the venom of a rattlesnake before she was born (prenatal influence), is utilized as the starting point of an imaginative and very interesting story, in which she is shown as being cold, possessing a hypnotic influence and

a mysteriously envenomed nature and is unable to love even though she wants to. In the "Letters of Oliver Wendell Holmes" we also find some very interesting correspondence between Dr. S. Weir Mitchell and the physician author in which Dr. Mitchell mentions some of his researches on Serpents, Venom of Rattlesnakes, etc., which were later published. It is also interesting to note that Dr. Holmes had a rattlesnake in his laboratory for a long period of time. Here he studied minutely at first hand the habits and other traits of this species of snake before writing his "Elsie Venner." When Dr. Mitchell sent to Dr. Holmes the skin of a large rattlesnake it was he who replied, "His bark is much more welcome than his bite would be."

Of course, you all know Kaa, the python, made famous by Kipling in his "Jungle Book," and his white cobra, which he also mentions here. Pope, in one of his poems, makes some interesting remarks concerning the rattler. And then without mentioning other literary references, it might be of interest to observe some instances where snakes are employed alone or with other symbols. Caduceus, the staff considered as a symbol and attribute of the Greek god Hermes and the Roman god Mercury is generally represented as having two serpents twisted around it in opposite directions, their heads confronting one another. Several different fables were invented to account for the presence of the serpents. The one most frequently quoted is that Apollo gave his staff to Mercury, who with wand in hand as he entered, saw two serpents fighting together. He threw the staff between them and they immediately wound themselves around it in friendly union. Among the moderns the caduceus serves principally as an emblem of commerce over which Mercury was the presiding divinity.

Æsculapius (Asclepios), the god of medicine among ancient Greeks and Romans, is commonly represented standing dressed in a long cloak with bare breast. His usual attribute is a club-like staff with a serpent, the symbol of renovation curled around it. This points to an ancient godly spirit. Whether this symbolic turning of a serpent around the staff of Æsculapius indicates a belief in its endowment with some extraordinary virtues in connection with the healing art is problematical. The cult of this Son of Apollo, who was deified as the god of medicine, spread rapidly after its introduction by Sophocles in Athens. At the foundation of each new temple a serpent, symbol of the healing god, was provided. Most of these

temples kept non-poisonous, tamed and trained snakes which were often employed for all manner of jugglery. The snake or worm largely represented the Egyptian's idea of disease.

From the earliest origin of Hinduism, its followers have worshipped the Cobra, representing it in pictures and in sculptures with many heads as a protecting divinity overshadowing kings and deities. Even to-day, the presence of a living Cobra in the homes of many natives in Asia is considered by them as an omen of prosperity.

There is an interesting book entitled "Serpent Worship—Ophiolatreia," which gives an account of the rites and mysteries connected with the origin, rise and development of Serpent Worship in various parts of the world, and it is enriched with interesting traditions and a full description of the celebrated Serpent Mounds and Temples.

SCIENTIFIC WRITINGS

It is impossible to give a detailed list of all who have written valuable scientific and general treatises on herpetology (the study of reptiles) or on observations of the characteristics of snakes. Almost all works on zoology describe and give certain valuable information concerning snakes. There are many interesting treatises upon the subject by writers who have been called to the far beyond. Of these, the works by Dr. S. Weir Mitchell and Dr. Noguchi are of interest. In considering recent writings, the following authors in particular must be mentioned when presenting any article on snakes.

Dr. E. G. Boulenger, the Great Belgian herpetologist, long at the British Museum, has written many of the most valuable works on Herpetology. Dr. Raymond Lee Ditmars, Curator of Reptiles and Mammals for the New York Zoological Society, has written several comprehensive books and articles, popular and scientific, which are invaluable in any study on Ophidians. Dr. Thomas Barbour, Director Museum of Comparative Zoology at Harvard University and of the Experimental Station and Serpentarium at Tela, Honduras, has contributed some interesting volumes and accounts of reptiles and amphibians. Dr. Leonhard Stejneger, of the United States National Museum, has presented several interesting works. Dr. Albert Calmette, of the Pasteur Institute, and Dr. Vital Brazil, known by some as the "snake farmer" of Brazil, are the pioneers in the production of anti-snake-bite serum, the former producing a preparation for use in India and Oriental countries and Dr. Brazil, producing a preparation for use in Brazil. And for the last name I leave the one who is

without a doubt one of the most interesting authorities in the Western Hemisphere to-day, Dr. Afranio do Amaral. As the first Director and at present the consulting Director of the Antivenin Institute of America at Glenolden, Director of the Seropathic Institute of Butantan, Sao Paulo, Brazil, and Lecturer at Harvard University School of Public Health, he has and is contributing through the Bulletins of the Antivenin Institute of America, and lay and scientific journals valuable data concerning venom, treatment of snake bite, antivenin, as well as general information concerning snakes.

There are of course many other works which are not mentioned here due to the fact that they comprise a small restricted or localized fauna and also for the reason that this is not intended to be an exhaustive list but merely one in which is to be found the authors of the most valuable treatises upon the subject of snakes.

SNAKE TALES AND SNAKE MYTHS

Who doesn't know a snake story? Harking back to the earliest periods of time till even the present-day snakes were and are endowed by man with a multitude of virtues, all sorts of mythical attributes and peculiar beliefs which are shared by young and old alike. The element of truth in most of these stories is practically nil. For the most part such stories are fables, delusions or superstitions. You may read these and enjoy them as mythical stories but not as truthful narratives as some people would want us to believe. The following are the most persistent and widespread snake myths or superstitions worthy of mention:

1. A snake when killed does not wait until sundown to die nor does the tail of a dead snake wiggle until the sun goes down.

2. Snakes do not swallow their young or the latter do not run up its mother's throat at the approach of danger and the mother does not spit them up again when danger has passed. If this ever occurred the strong digestive fluid in the stomach of the mother snake would kill the eggs. What probably happened was that the mother hid the young under its own body for the time being so that they are not observed. Snakes eating young and smaller snakes (cannibalistic) and the finding of living broods ready to be expelled have led to this tale.

3. The tips of snakes' tongues are not poisonous fangs.

4. The spreading or hissing viper, blow snake or puffing adder, or hog-nosed snake due to its actions of hissing, striking, other alarm-

ing manœuvres, and its habit of feigning death have given rise to various superstitions and stories. It does not blow a poisonous powder or spray from its mouth. It is entirely harmless. All of its acts are a blúff and it merely seeks to frighten its enemy. It is undoubtedly a pugnacious, vicious-looking and terror-acting snake, but looks have never killed anyone.

5. The milk snake (Ophibolus doliatus) or other snakes do not steal milk from cows or from dairies. The story is as ridiculous as it is untrue.

6. The number of rattles possessed by a rattlesnake does not indicate the age of the snake (tradition has it that each joint to the rattle means one year added to its age) nor does it indicate the number of human beings killed (the Indian tradition has it that each rattle indicates the death of one human being). These stories are merely idle fancies.

7. Not all snakes that produce a rattle are rattlesnakes. Snakes like the bull-snake and others vibrate their tails violently when excited and their tails may, when in contact with leaves, twigs, boards, etc., produce a realistic rattle. These snakes, however, do not have rattles or segments of dry horny skin as do the rattlesnakes.

8. The coach-whip snake (Zamenis flagelliformis), swift-moving, slender, almost as thin as a whip, is entirely harmless and does not snap its body like a whip as many of the superstitious folks in the South believe. It may on rare occasions follow a moving, unaccustomed object for a short distance, but it will never overtake you, coil itself around your body and thrash you with its tail, thus torturing you to death.

9. The red-bellied snake, also known as the "hoop snake" (Farancia abacura), is endowed with a tail which is armed with a minute spine as sharp as a needle. This tail cannot pierce or sting anything.

10. This "hoopsnake," previously mentioned, does not have horns on its tail and it is unable to place its tail in its mouth and roll along like a hoop. Such story is entirely mythical.

11. Poisonous snakes do not necessarily coil before they strike. Contrary to belief snakes with but very few exceptions do not attack humans wantonly. Most snakes are really lazy and timid and strike only when hurt or threatened with attack.

12. Snakes cannot hypnotise nor are they possessed of the mysterious powers of "charming." The fear developed, or the fact of

becoming panic-struck at the sight of a snake with the result that one's power of motion or the exercise of other powers are at a standstill, have led to this belief.

13. Snakes do not go "stone blind." They may during shedding show impaired vision, but not complete blindness.

14. Snakes cannot and do not travel on a smooth surface. They cannot and do not climb trees in spiral fashion. Poisonous snakes cannot and do not jump completely off the ground when striking.

15. Alcohol internally or externally is not a remedy for snake bites. In fact its use is harmful. You have heard all kinds of stories about people getting drunk after being bitten by a snake and that this served as the proper remedy. In those cases, the biting was done by a harmless snake and in the few instances where it might have been a poisonous snake, the fangs did not penetrate deeply into the skin or they did not deposit a sufficient amount of venom to exert a harmful effect, so that no treatment at all would have done the same amount of good and undoubtedly more when we consider the physiological action of the alcohol. You know the story they tell about the fellow who, unable to get any liquor, ran into the tavern and asked to have wrapped quickly two quarts of whiskey to use for a snake bite. When the remark was made that two quarts was SOME DOSE, his reply was that the biting was done by SOME SNAKE.

ORIGIN OF SNAKES

Reptiles sprang from the Amphibia, which in turn came from the fishes. The Amphibians known today, including the frogs, the newts and salamanders, the legless cœcilians (which at first sight resemble earthworms), are perhaps more specialized than the ancient order of this class which undoubtedly display the relationship just mentioned. Amphibians differ from the Reptiles not only in possessing a soft, slimy, scaleless skin, but they normally pass through a larval stage during their cycle of life.

Among the reptiles themselves, the average observer seems to regard snakes as primitive and not as highly developed as the lizards. The actual facts are that the latter are the more generalized group from which the snakes have sprung.

CLASSIFICATION OF SNAKES

I will attempt to present a consideration of snakes as a whole and in a general way. Elaborate descriptions of individual species is impossible and all that can be accomplished in the time allotted is to limit myself to a con-

sideration of classes and groups. Your interest will also be directed mainly to the North American Snakes though a general idea of the other Snakes or Ophidians will be given so that you may have some comparison between the different members of this Order.

NECESSITY FOR SCIENTIFIC OR TECHNICAL NAMES

Names common to particular species of snakes may vary, depending upon the location, so that the same species of snake may have several names by which it is known. In rare instances, a name common in one territory may apply to an entirely different species of snake than the species to which this same common name is applied in another area. It is for these reasons that scientific names are required for absolute identification of a species as such name is employed the world over by those interested and under no conditions do we have the same species labeled with different scientific names, due to differences in locations. In most instances scientific names have also an interesting or descriptive meaning. Take the Crotalus horridus, commonly found in the mountainous areas of Pennsylvania and also occurring from Central Vermont to Northern Florida and westward to Iowa, Kansas and Eastern Texas. The name Crotalus means "rattle," while horridus means "terrible." Due to its cross bands of color, it is known as the "banded rattlesnake." In other territories it is known as the "timber rattlesnake" due to its fondness for mountainous ledges, scattering to the timber during the warm months. In the canebrakes of South Carolina and in fact all along the South, it is known as the "cane-brake rattlesnake." Unfortunately in some areas the name "diamond rattlesnake" is applied to this species. This latter synonym is apt to be confusing, for other species of rattlesnakes carry this title.

Perhaps I may suggest another good use for these scientific names. Farmers in various localities are troubled by trespassers who kill harmless snakes which, as the effective natural enemies of rats and rodents, save their crops. To those farmers who are aware of the great value of the numerous harmless snakes and don't want them killed, I would suggest the following notice at conspicuous points about their premises:

Trespassers, take warning! All persons trespassing do so at their own risks, for although common snakes may be found here, the Pituophis sayi abounds everywhere about here and never gives warning of its presence.

The Pituophis sayi is the Bull Snake (or any other scientific name of the species valuable to the farmer and prevalent on that farm may be inserted). The average individual would probably not molest such place due to the fear which would be imparted by what he would believe is a deadly enemy bearing the scientific name on the sign. The valuable snakes would do their work and the farmer would be able to gather the maximum yield of his crop in peace.

CLASSIFICATION ORDER OPHIDIA

Family—Typhlopidæ—These are small, degenrate, harmless, burrowing snakes, the upper jaw only being toothed, and they look like the degraded lizards or even worms. The many species of the few genera are to be found in Central and South America, West Indies, Mexico, Southern Europe, Southern Asia, Africa, Australia and Malay Archipelago.

Family—Glauconiidæ (Blind Snakes)—In here are found diminutive burrowing, harmless snakes, the lower jaw only is toothed, and these species are observed in the warmer parts of the Old and New World. They feed upon worms and insect larvæ.

Family—Boidæ—Subfamily—Pythoninæ (Pythons) (containing a bone, the supra-orbital, above the eye, and absent in the Boas and other snakes) and Subfamily—Boinæ (Boas). There are many diminutive and moderate size species. Some are arboreal and others burrowing. The Pythons and Boas, better known for the presence of species of large dimensions are among the most sensational of the reptiles. Members in this family, though true snakes, are characterized by the protrusion of a pair of internal hind legs in the form of a pair of stout spurs, which are vigorously movable and also capable of inflicting an ugly scratch. Vestiges of these hind limbs terminating at times in a claw-like spur may occasionally be visible externally. All species are devoid of venomous properties, but the monster Pythons are capable of producing formidable lacerations with their long, recurved teeth. They are capable of crushing to death and even swallowing humans, but they are rarely bold, or hungry or vicious enough to do this. They, however, live upon warm-blooded prey, either mammals or feather creatures, as pigs, chickens, etc., and they usually kill their prey by constriction due to the presence of strongly developed muscles. The Pythons are confined to tropical and semitropical areas of the Old World while the Boas are to be found in both hemispheres. Differences between Pythons and Boas are confined mainly to the bones of the head and the arrangements

of the head plates. The king of the big constrictors is the Regal or Reticulated Python, known by the natives of Malay as the Ular-Sawa and which may grow to a length of 30 feet, very stout in proportion to its length, weighing approximately 300 pounds and possessing a coloration the beauty of which is beyond description. Pythons usually lay their eggs, coil about them until they hatch in about two months' time. Most of the Boas bring forth their young alive. Of the Boas, the largest one to be seen in this hemisphere is the Anaconda or Water Boa of Central and tropical South America, which may be as long as 30 or more feet. Laymen seem to indiscriminately label all big snakes (whether Pythons or Boas) as Boa Constrictors. The specific Boa Constrictor or the Common Boa, a native of tropical South America, is in reality not an especially large snake, being rarely over 12 feet. It is a reptile of generally docile nature, takes readily to captivity and therefore sought by snake "charmers." In the United States, especially along the Pacific Coast region, a few small species of Boas are to be found. These are the Rosy Boa (Lichanura roseofusca) occurring but infrequently; the Three-lined Boa (Lichanura trivirgata); and the Rubber Boa (Charina bottæ), which is also popularly known as the Two-headed Snake, because the tail is almost as blunt as the head. In Cuba and Porto Rico, both of which islands are free of poisonous reptiles, a big and powerful species found is the Cuban Boa which when it strikes emits a hiss sounding like a sneeze.

Family—Ilysiidæ—In here are to be found a few burrowing species and other small, harmless, constricting snakes, closely allied to the Boas and which are mainly found in damp forests (usually at some elevation) in Asia and tropical South America. Many species are beautifully colored.

Family—Uropeltidæ—Here are listed a large number of small, harmless, burrowing snakes inhabiting India and Ceylon.

Family—Xenopeltidæ contains a harmless burrowing species found in Asia.

Family—Colubridæ—This the largest family of the Ophidia, found all over the world, is a very cosmopolitan family, for almost 90 per cent. of all living snakes are found listed here. It is the members of this family which are most frequently seen and which leave one with the general impressions formed concerning snakes. There is an assortment of forms, sizes, habits, and varied coloration. They may be arboreal, terrestrial, subterraneous, semi-aquatic, persistently

aquatic, and marine species are also known. Many are harmless, some are powerful constrictors, others bolt their prey alive, while species containing poisonous fangs are also to be found in this family. Here are included some that are being used in industrial pursuits. Oviparous species (those that lay their eggs) predominate, though the methods of laying these eggs and subsequent hatching vary. Viviparous species (those that bring forth the young alive) are also common. A knowledge of the skull, especially arrangements of head plates, and in particular dentition and the terminology of the scales, are provisions employed to classify this large family, many species of which look alike externally. The number of the abdominal and subcaudal plates, the coloration of a species and the locality where it was found are other important factors which may aid in identification and classification.

The Colubridæ are subdivided into three sections: (1) The Aglypha, which possess solid teeth, no grooved or perforated fangs and are harmless; (2) the Opisthoglypha, back-fanged snakes, containing one or more pairs of grooved venom-conducting fangs in the rear of the upper jaw (posterior maxillary teeth grooved). Though suspicious as possessing poisonous venom, the latter is but mildly poisonous to man, being mainly used by these snakes to benumb their prey, which are usually other snakes; (3) the Proteroglypha (front-fanged snakes with grooved teeth), which contain a pair of short, rigid, venom-conducting fangs in the *front* of the *upper* jaw (anterior maxillary teeth grooved or canaliculated). Here are to be found many of the most deadly poisonous snakes.

The Aglypha, we find, are divided into three subfamilies: (a) Acrochordinæ, which contain river snakes, usually ugly in appearance, possessing wart-like tubercular scales and found in the rivers of Southeastern Asia and Central America. They feed on fishes; (b) Colubrinæ, which contain most of the commonly found and typical harmless snakes; and (c) Rhachiodotinæ contains the egg-eating snake found in tropical and South Africa.

The Colubrine snakes include all types which display varied habits, marked differences in size, are usually harmless, but some species may become vicious and are capable of inflicting severe lacerations. The following are the important genera and species: Eutænia, the Striped, Garter or Ribbon Snakes, are the most abundant of North American snakes and are commonly found in United States and Mexico. They multiply rapidly, giving birth to forty or fifty, and as

many as seventy-five young in a litter. They are viviparous. They thrive upon earthworms, frogs, toads, etc., and are cunningly secretive. They are harmless and inoffensive. They are of no value to the agriculturist as they feed solely on cold-blooded prey.

Tropidonotus, or the Common Water Snakes, found abundantly in temperate and tropical parts of the Eastern and Western Hemispheres are usually found near water. When cornered they may display a vicious temper and are often mistaken for poisonous snakes and known accordingly under the misleading title of water "moccasins." All species in this genus do not produce venom. They eat fish, frogs, toads, and other cold-blooded prey. Their average size is 3 feet and their bodies are proportionately stout. They are usually found sunning on derelict timber, on branches of trees overhanging lakes, streams, etc., and they may be found associated with the deadly water moccasin. They are easily frightened and in times of danger they drop or retreat into the water, being agile swimmers.

The genus Lycondon contains few species which are of interest, in that many of its members resemble the much dreaded poisonous snakes belonging to the genus Bungarus (the Kraits).

Zamenis or the Racers are oviparous vicious snakes, species of which are numerous and found in the Old and New World. They are usually of large size, very agile, and hunt in the open for their prey, usually small rodents, frogs, birds and other young snakes. The important Old World species is the India Rat Snake. In this country two important species are the Coach-Whip Snake and especially the American Black Snake or Black Racer. Black Snakes are found in areas from the Atlantic to the Pacific. Their smooth, satiny black scales impart a gun-barrel lustre to the back. They are easily recognized. It is unfortunate that this species should be generally feared and usually slaughtered, for it is of considerable value in fields and woods in destroying rodents. If surprised this snake will disappear quickly, due to its agility, but if cornered, it will fight viciously, and dart for about half the length of the body at the aggressor. The worse that can happen if it should bite is a few scratches on the skin. It is not a constrictor.

Coluber—the Rat Snakes—Members here are generally powerful constrictors and feed upon warm-blooded prey, especially mammals and birds. They are usually powerfully built, possess flat abdomens, glossy scales, large eyes and average 5 feet in length. They inhabit the temperate and tropical parts of the Old and New World. The

most widely distributed species in this country is the Pilot Black Snake found from the Atlantic to the Mississippi and from Massachusetts to Florida. It was thought that this snake warns and leads the slower moving venomous rattlesnake and the copperhead to safety and thus the name Pilot. This theory which is incorrect arose from the fact that this snake is found frequently, especially in the North, in the same localities with rattlesnakes and copperheads. Then we have other species, especially those known commonly as the "Chicken Snake" (a misleading popular title), the "Corn Snake" and the most attractive of the European Colubers, the "Leopard Snake." Many species of this genus will prey upon domestic poultry, especially young chickens, and their eggs.

Pituophis—the Bull Snakes—Species in this genus possess short-pointed snouts and in this country are perhaps the largest of North American harmless snakes. Due to a characteristic cartilaginous filament in the mouth, these snakes are capable of producing a loud, hissing sound. They are constrictors, usually oviparous, and feed upon warm-blooded prey. They are of great value to the agriculturist.

Heterodon is a genus of the Colubrinæ, containing many important species commonly known as the "Hog-nosed Snakes," "Blowing Adders" and "Flat-headed Adders" or "Sand Vipers." These species are found in North America, live entirely upon the ground, feeding mainly upon toads and occasionally on frogs. They are very strong in proportion to their size, which is never over 3 feet, look ugly and formidable but lack any constrictive powers. They are harmless, cannot and will not bite, though they hiss loudly and assume the most threatening attitudes, even dilating their necks, and in a way imitating the Cobras of the Old World. The hissing breath is not poisonous and the threatening attitude is in reality a display of an ingenious, harmless bluff so as to frighten away an attacker.

The genus Ophibolus contains several species found mainly in United States, Mexico and Central America. The species in this country are known as the "King Snakes," the best known member and typical form being the "Common King Snake or Chain Snake." Though gentle in their attitude toward man, who employs them as pets, and though rarely attacking members of the same genus, they display a surprisingly cannibalistic attitude towards other kinds of snakes and lizards. They can live for years without food, will eat dead animals, though they are fond of small rodents and young birds.

Their range of sizes is from 1 to 6 feet in length. They are apparently immune to the venom of all species of poisonous snakes, except to that of the Cobras. A ridiculous and fabulous story circulates concerning several species of this genus which are known as the Milk Snakes found in various parts of our country and which are alleged to steal milk from cows. Members in this genus are among those snakes that "mimic" the Coral Snakes.

The Ring-necked Snakes, embracing a few species and placed in the genus Diadophis and the Scarlet Snake placed in the genus Cemophora, are found in this country. The Scarlet Snake, a constrictor, feeding on mice, small snakes and lizards, is a beautiful serpent and is apt to be mistaken by the novice for the poisonous Coral Snake, but the differences in the pattern design aid in identification.

The Rainbow or Mud Snake, belonging to the genus Abaster, and the Red-bellied Snakes placed in the genus Farancia, are other members of the Colubrinæ that occur in the southeastern part of this country. These are beautiful reptiles, 4 to 6 feet in length, lead a subterraneous life and are harmless. The negro folks have circulated a ridiculous story about the Red-bellied Snake taking its tail in its mouth and rolling along at a rapid speed, resulting in the naming of this snake as the Hoop Snake.

The other subfamily of Aglypha is Rhachiodontinæ, which contains one important species found in South Africa, the Egg-eating Snake. The food of this species is restricted almost entirely to eggs.

The back-fanged snakes or those grouped in the section or division known as the Opisthoglypha were at one time classed with the innocuous snakes. They possess poison-glands and fangs, but these are reversed or found in different regions as compared with the position where they are found in the important venomous snakes. The fangs, either one or several in number, are furrowed or grooved and are situated in the extreme rear of the upper jaw. Due to this position of the fangs, a dangerous bite can only be inflicted upon humans when the serpent gets a hard grip with its jaw, and this rarely happens as the Opisthoglypha snakes are shy. They are, however, very active and quick, killing their prey rapidly after first benumbing their victim with their venom which seems to affect mainly the nerves. This cosmopolitan division contains many genera and species mainly found in warm areas and in the tropics. Here we find the Poisonous River Snakes (Homalopsinæ) which feed on fish, other members of the subfamily Dipsadomorphinæ which live on trees and may be

brought into our midst by shipments of fruit coming from areas inhabited by these serpents and then others are terrestrial, subterraneous or semiaquatic.

The front-fanged snakes belonging to the section or division Proteroglypha of the Colubridæ are the most deadly species of snakes known. Two important subfamilies are recognized: (1) Hydrophinæ or the Sea Snakes, which are strictly marine species, possessing strongly compressed, oar-shaped tails; and (2) Elapinæ, the Elapine or land snakes, which are terrestrial species representing the most deadly of the poisonous snakes, and which possess cylindrical tails.

There are several genera and many species of poisonous Sea Snakes which occur mainly in the waters of the Old World, particularly the Indian Ocean and in the tropical parts of the Pacific. The only important member of this group found in the New World, and which is also found in the Old World, is the Yellow-bellied Sea Snake which occurs in Central and tropical South America.

The Elapine Snake include the Cobras and their many allies in the Old World and the Coral Snakes in the New World. Australia, containing a predominance of poisonous snakes, abounds in these Elapine species. Perhaps the most interesting of the Elapinæ are the Cobras (genus, Naja) which contain many species widely distributed over Asia and Africa. The Cobras more so than any of the other snakes, and in particular the Spectacled Cobra or Cobra-de-Capello, known scientifically as Naja tripudians, have acquired notoriety and are the cause of a considerable loss of life. The Cobras are known for the habit of spreading the neck into a "Hood" when angered. This characteristic is especially marked with the Spectacled Cobras when at the same time they rear the anterior portions of their bodies, usually a third the length from the ground, and when spreading the "hood," disclose a weird marking on the distended skin which might be likened to a pair of large, glaring eyes covered with a figure similar to a pair of spectacles. The fangs situated on the forward part of the jaw are short, stout, and always erect. Cobras are hostile, vicious serpents, strike quickly forward and downward after first hurling itself into its characteristic upright position. The action usually accompanied by a sharp hiss results in the ejection of the venom which usually produces fatality, death resulting from the production of a general paralysis. Cobras feed on small rodents, birds and eggs, which are swallowed entire. The average size of a large Spectacled Cobra is 2 inches in diameter by 6 to 6 and a half feet in length. A

smaller and less spectacular Cobra than the India or Spectacled Cobra is the Egyptian Cobra, Naja haje, which either this species or the Egyptian viper, Cerastes cornutus, is the Asp which is concerned in the suicide of Cleopatra. The most deadly of the Cobras and of Old World serpents is the King Cobra or Hamadryas, Naja bungarus. These are slender serpents, reaching a length even as great as 12 feet, are oviparous and look anything but vicious or poisonous. They seem to possess a marked degree of intelligence. They are cannibalistic.

Closely allied to the Cobras is the genus Bungarus, which contains the dreaded poisonous semi-nocturnal snakes known as Kraits. The common species are found in India and adjacent areas and cause a loss of many lives. They, however, bite only when molested and usually do not retreat when attacked but hide their heads under the coil of their body. We also find in the same subfamily the Ringhals of South Africa (Sepedon hæmachates), which has a habit of "spitting" its venom when cornered or angry. The Mambas, belonging to the genus Dendraspis, found in tropical and South Africa, are semi-arboreal snakes. One species found here is an active, bold serpent, and like the King Cobra is said to pursue one when disturbed. The Death Adder (Acanthophis antarcticus), one of the important poisonous snakes found in Australia, is one of the most dreaded of the Elapine snakes.

There are other genera closely related to the Cobras or Hooded Snakes, but most of these are found in countries other than the New World. The one important genus representing the Elapinæ in the New World is the genus Micrurus (Elaps), occurring in Southern United States, Mexico, Central America and tropical South America. These are the Coral Snakes, which when examined quickly resemble many harmless snakes, but if carefully examined one will find that the poisonous Coral Snakes display single black rings bordered with a pair of yellow rings while the harmless snakes which appear almost similar possess single yellow rings bordered with a pair of black rings. Species of Coral Snakes average about 3 feet in length, possess a cylindrical body, are secretive, addicted to burrowing habits, and are cannibalistic, feeding upon other species of snakes and lizards. Coral Snakes bite as do the Cobras, advancing their fangs in a chewing motion, but they strike on an object only when touched. Due to their short fangs, ordinary clothing is sufficient protection against the latter and the venom which passes through. The most important

species of Coral Snakes in this country is the Harlequin Snakes or Coral Snakes commonly found in Florida, Georgia and South Carolina. These snakes are usually found after heavy rains and are frequently dug up during ploughing.

Family—Amblycephalidæ—Leaving the Colubridæ and its several sections, subfamilies, many genera and large number of species, thus making this the largest family of the Ophidia, we come to the family Amblycephalidæ. The latter is composed of harmless snakes inhabiting Central and South America and Southeastern Asia. Known sometimes as the Chunk-headed Snakes, the members of this family seem to connect the Colubridæ to the Viperidæ, though they are more closely related to the former.

Family—Viperidæ—The thick-bodied, long-fanged, venomous snakes are placed in the family Viperidæ. These Viperine Snakes are the most specialized among snakes in the development of the poison apparatus. The family Viperidæ is divided into two subfamilies, the Viperinæ, the True Vipers, or the Vipers Proper found mainly in the Old World, and the Crotalinæ or Pit Vipers, found most frequently in the New World, but some species are distributed throughout the Old World.

The True Vipers are divided into nine genera containing many species found extensively over Europe, Africa and the greater part of Asia. The genus Vipera contains the type species. Here we find the Common Viper (Vipera berus), the only poisonous snake inhabiting the British Isles; Orsini's Viper (Vipera orsinii), found in the plains of Austria and Hungary and in the mountains of Italy and the adjacent Alps; and Russell's Viper (V. russelli) or Tic-polonga, found in India and the East Indies. The Common Viper, Vipera berus, the only poisonous snake found in Great Britain, is a rather small, pugnacious snake biting like most of the other Viperine snakes in a quick, lightning fashion. One of the common and most deadly snakes of India is V. russelli or Russell's Viper, a beautiful looking 4 to 5 foot reptile. This, like most of the other species of genus Vipera, hisses sharply and steadily with each intake and exhalation of the breath, the body in most instances rising and falling like a bellows. Members of the genus Bitis are restricted to Africa and though inert and sluggish, they are generally feared on account of their usually fatal bite. The important species are the Puff Adder (B. arietans), the Gaboon Viper (B. gabonica) and the Nose-horned Viper (B. nasicornis); and genus Cerastes contains two species found

in Northern Africa, Arabia and Palestine, C. cornutus, which is known as the Horned Viper because it contains a pair of large, erect, horn-like scales found above the eyes, and C. vipera, in which horns are always absent.

The Puff Adder, belonging to the genus Bitis (specifically Bitis arietans), is widely distributed in Africa. It is especially vociferous during its inhalation and exhalation, whence the name of Puff Adder. It is a villainous looking snake, possessing burrowing characteristics and feeds on small mammals. The Horned Viper or Asp, Cerastes cornutus, found in the northern desert region of Africa and Southern Asia, figures historically in the suicide of Cleopatra.

The Pit Vipers, subfamily Crotalinæ, are the ones which concern us in this country, for most of the poisonous snakes in United States are found listed here. The only others are the Coral Snakes, the Elapine Snakes, distantly related to the Cobras, which were mentioned previously. Every species in the several genera listed here are quickly recognized by the presence of a deep pit between the eye and nostril. The exact function of the pit is not known, but it does aid us in immediately identifying a Crotaline Snake. A unique group found in this subfamily and one which concerns us very much in this country is the Rattlesnakes possessing a remarkable caudal appendage. The snakes possessing a tail with a rattle belong to the genera Sistrurus and Crotalus. Practically every part of this country is inhabited by some species of rattlesnakes. The latter with the Water Moccasin or Cotton-mouth Snake and the Copperhead Snake belonging to this same subfamily, genus Agkistrodon (Ancistrodon), are the dangerous poisonous snakes we find in this country. It is, however, to be remembered that the poisonous snakes, including these last mentioned and the Elapine reptiles (Coral Snakes) in this country, are in the minority, being present in an amount of less than 15 per cent. of the total, the reptile life being comparatively large in this country.

The important species of the genus Ancistrodon is the Water Moccasin or Cotton-mouth Snake (A. piscivorus), which is found mainly in the swampy areas of the southeastern portion of the United States. This is a dull olive, semi-aquatic, pugnacious, irritable, ugly serpent possessing a stout body and averaging 4 to 5 feet in length. It feeds upon fish, frogs, birds, small mammals and other species of snakes for it is cannibalistic. The name "cotton-mouth" is due to the fact that when this serpent opens its mouth, the parts that are disclosed are white as cotton, this contrasting very noticeably with the

color of its body, which is rather dark or blackish. The Moccasin produces small broods of living young. Bites by these reptiles are not frequent, due to their semi-aquatic habits and also to the fact they generally attempt to slip away and escape and will only strike with their fangs when approached very closely or cornered.

Another species of this genus and one of the most beautifully colored pit vipers found in this country is the Copperhead Snake (Ancistrodon contortrix) (or Agkistrodon mokasen). This is not a large serpent. It is highly venomous and is usually found in the eastern and central portions of the country, though it also occurs frequently in extreme southern areas, especially in Texas. The Copperhead Snake is vicious, feeds on frogs, birds, small mammals and other species of snakes and is viviparous. Though the venom of this poisonous serpent is very powerful, being perhaps more deadly than the venom of other poisonous snakes, it is but infrequent that humans are inoculated with it by Copperhead Snakes as the latter are rarely aggressive. They will only strike when cornered or when one is within very close proximity and the comparatively small fangs and small amount of venom secreted may not always be capable of penetrating heavy clothing, etc.

The genus Lachesis or Bothrops contains many species found only in Central and South America and Southeastern Asia. None are found in this country. A strikingly colored, interesting and most terrible creature is a member of this genus found in Central and tropical South America known scientifically as Lachesis or Bothrops mutus and otherwise as the Bushmaster, Sirocucu or the Mapepire. It is the longest of the Pit Vipers, attaining a length of 12 feet. It is slender in comparison to its length and is very active. It is also interesting that this species in contrast to the other Crotaline Snakes is not viviparous but lays eggs. Another formidable member of this genus found in Central and tropical South America is the Fer-de-Lance (Lachesis lanceolatus or Bothrops atrox).

The two genera, Sistrurus and Crotalus, include the group of serpents known the country over as the Rattlesnakes. The appendage, the rattle, is the characteristic by which members of these genera are identified. The stories told about the function of the rattle, its purposes and indications and other fabulous assertions would require an evening's lecture in itself. Though it serves to warn intruders, this is perhaps incidental and probably not nature's intent for its presence. The segments of the rattle do not indicate the age of the serpent.

Many of these stories are fallacies. The true purpose is in reality not known and any apparent scientific explanation which is given is probably a theoretical assumption.

The rattle is composed of hollow segments of dry, horny skin each fitting loosely into one another. At birth, the rattle is represented merely by a button, the growth starts from the end of the tail proper and a new ring or segment growing larger and larger is uncovered each time the snake sheds its skin, until when the snake attains its full growth, all of the segments produced thereafter are of uniform size. The characteristic rattle appears among all species, and its presence is sufficient to warn one of the poisonous character of a snake.

The genus Sistrurus contains the Pigmy or Ground Rattlesnake (S. miliarius), a small, attractive reptile with a tiny rattle, found in the southeastern part of this country, and the Massasauga (S. catenatus), a somewhat larger species, found in the swampy regions of the Central and Southwestern States.

The typical rattlesnakes belong to the genus Crotalus, the species of which differ from those in genus Sistrurus by showing in most instances small, granular scales on top of the head. Members of this genus eat warm-blooded prey only, mammals and birds, while those in genus Sistrurus feed largely upon frogs. The important rattlesnakes in this country, members of this genus, are the Black-tailed Rattlesnakes; Banded or Timber Rattlesnakes, a beautiful reptile distributed far and wide over the country; the Diamond-back Rattlesnakes, the largest of rattlesnakes, the most deadly of North American poisonous serpents and possessing huge fangs and enormous poison glands; the Western Diamond or Texas Rattlesnakes, another large species of this genus; the Prairie Rattlesnakes, a moderate size reptile commonly found in the Plains; the Pacific Rattlesnakes; the Tiger Rattlesnakes, the White Rattlesnakes and others found in Mexico and other parts of the United States.

USES OF SNAKES Style—what hasn't been committed in thy name? Even the snakes have to do their bit so that milady may have adornments on one thing or another.

Startling as it may seem, it is nevertheless a fact that up until five years ago the skins of reptiles were not used commercially. We all perhaps remember having the harness worker fix some snake hide on our belts or other wearing apparel, but the secret of tanning reptile

leather for commercial purposes was only brought forth recently. Reptilian skins with their exotic beauty softened and kept permanently pliable, yet retaining the bizarre pattern marked by nature are now available for the designer to make snake shoes or to a less extent for ornamenting or trimming coats, purses, bags, gloves, pocketbooks, automobile and other upholstery, luggage, golf bags and sticks, canes, umbrellas, cigarette cases and lighters, handles of toilet articles and other accessories. It possesses the best of wearing qualities, durability, adaptability, beauty and at present, style has decreed its popularity. The use of snake skins is adapted also wherever light weight, but strong leather is desired.

The collection of snake skins for the production of hides is not necessary to be under the supervision of scientists or naturalists. The collection of these skins is organized in a way on the same basis as the rawhide business of other hides (calf, goat, sheepskin, etc.) is organized.

Not all of the different species of snake skins are suitable for commercial use; and just as with furs, other leathers and wool, not all species of these animals bearing the raw products are used. Climatic conditions and in some instances other factors influence the state of the pelt and its value to man. Perhaps of the several species of snakes, the Water Snakes are used in greater numbers, the Karung, a water snake of Java, Hindu China, Siam, Borneo, Batavia, and adjacent sections, supplying the largest volume. There are approximately one and a half millions of these snakes used in this country and in Europe in the tanning industry. Water Snakes are usually easy to catch, the species employed are generally non-poisonous and they are most popular due to the delicacy of their markings. The natives simply reach over the edge of the river bank and with lightning quickness, the slippery reptile is caught and thrust into a box or other suitable container. The next most desirable of the various snakes is the Python. This, though not poisonous, is very deadly, due to its constricting and crushing powers. It is, however, easy to catch a Python when once located, due to the fact that it has a weakness for fresh goat. A live goat or other suitable meat is tied near the location where the Python is found. The natives then retreat to a safe distance and after the Python has gorged itself with the fresh meat, it lies in a state of stupor. In this state it is caught and placed in a suitable container. The best Python skins are obtained from the jungles of India and Java and range in size from 8 to 30 or 35 feet in length. There

are approximately one-third the amount of these skins as compared to the skins of Water Snakes which are used annually. The Boa is also used mainly because its skin is generally cheaper. The latter, however, is not a desirable pattern. The Boas are imported from all of the Far East countries except Japan, Korea and Northern China. Some skins from Boas are also obtained from South America. Probably over 98 per cent. of the snake skins are Water Snakes, Pythons, and Boas. The skins from the Cobra, though a gorgeously marked snake, is employed but infrequently. The Buddhists consider this snake sacred and due to this religious prejudice the quantity of Cobra skins used is probably very small. New snake skins are coming on the market at all times. The jungles of the world and everywhere where snakes are to be found are being searched for snakes in which the skins reveal a pretty pattern and which would not be too small for general use. Snakes which are usually located in the deep sea by pearl fisherman and sponge divers and coming from the Far East have recently reached the market. The snake supply in this country is very limited. Probably not over 10,000 snakes are killed and cured annually and which skins are marketable as commercial products. And in temperate climates where civilized man is to be found in greater numbers one finds that the various snakes are becoming fewer in number. Snake skins are used in "upper" of the shoes, that is the top covering. They are difficult to tan and it was for this reason and not for the lack of appreciation that this industry remained undeveloped until science evolved a procedure of preserving reptile skins by tanning. The American tanned reptile seems to exceed in quality, finish and style possibilities so that the skins tanned in this country are apparently more in demand. This country, though more distant from the source of raw stock or raw product is, however, nearest to the source of demand and accordingly has taken the leadership in reptile tanning.

OTHER USES OF SNAKES

Various parts of the snake, and in particular its internal organs have been supposed by the credulous to possess peculiar virtues and accordingly employed in the production of salves, oils and other medicinal agents. Formerly it was a common occurrence to find that certain Indian tribes would poison the tips of their war-arrows with the venom of poisonous snakes (in this country rattlesnake venom was commonly used). Their use in ceremonials and among the charms of the medicine-man and by snake-charmers is well known.

SNAKES AS FOOD

Primitive man in the differentiation between a food and a drug probably ruled that which proved to be pleasing to the sight, palatable to the taste and non-injurious after consumption was a food, while that which was distasteful or unsightly, and especially that which proved harmful after consumption, was a drug. Snakes being unsightly or feared or due to religious and other prejudices were not adopted by many as a food. Yet testimony indicates that snakes can be made appetizing as a food just as frogs, and turtles and other closely related amphibians and reptiles. In fact, one individual who ate fried rattlesnake informed me that it tasted like chicken. Another states that it tastes like eel. Many people in foreign countries, primitive and others, with less inherited prejudice, do eat snakes. The Australians, the African bushmen and the Indians throughout the American tropics eat snakes (usually large snakes) whenever they can be obtained. It is also interesting to note that at our own Pennsylvania State College, the freshmen foresters, who spend six weeks at the end of their freshman year in a forestry camp, have had what they call a "rattlesnake feed." A rattlesnake is captured, fried, cut up into bits and each student has a taste. This comprises the so-called "rattlesnake feed" at State College concerning which all kinds of fallacious stories appear annually. In fact, Professor J. A. Ferguson, of the Department of Forestry, informs me that "these stories have grown to mammoth proportions and have been printed in England and Scotland with the statement that we furnished rattlesnakes to our students in lieu of meats."

To-day's dreams and imaginations may result in their realization to-morrow. So perhaps the dish of rattlesnake may some day come into its own as a food.

SNAKES OF VALUE TO THE FARMER

Until but recently and the prejudice is as yet entirely too common, farmers regarded snakes as their enemies. They little realize the economic value of the reptiles in destroying injurious mammals. An actual loss in money is suffered when misguided and thoughtless persons indulge in the killing of harmless and yet valuable snakes by disguising their act as a falsely superstitious hatred of snakes. When snakes are found congregated in fields, around grain, about barns, etc., the farmer immediately determines that they are useless or injurious to his crops and they immediately take measures to eradicate

the reptiles. Little do they realize that the presence of these snakes is instinctive in that they congregate where gophers, mice, rats, and ground squirrels are found. The latter gnawing animals damage the grain and cause the considerable trouble and loss for the farmer. Take, for instance, the "bull snake," which can make its way into a narrow hole and trap the rodents in their subterranean homes. This and similar snakes are actually more effective natural enemies than the hawk and the fox, who have to wait for the appearance of the rodents above ground. If the foolish prejudice against harmless reptiles would not prevail the latter, if not destroyed, would destroy many of the rodents and thus aid in preserving the profits of the agriculturist. It would be an easy matter for an intelligent farmer to learn merely the differences in gross appearance between harmless and poisonous snakes if the latter were known to be found in his vicinity, and then allow the former which are frequently common to go unmolested.

SNAKES AS PETS Reptiles and Amphibians have become popular in certain circles as pets. Lizards, snakes and horned toads in particular have been chosen. The reasons for employing snakes as pets are varied, but usually due to some eccentricity on the part of their owners.

SNAKE CHARMING Is it an art? How do these Orientals and others perform their snake charming and seem to elicit swaying of the Cobra or other species of snakes to the tune of some weird music producing the so-called "snake dance"? All travelers in the Orient are familiar with the sight of the filthy, fat native who mumbles and whistles and beats a tambour or blows through his pungi (a bottle-shaped gourd with two bamboos or reeds inserted), emitting weird sounds or shrill-penetrating wheezes and whines, to which the Cobra wags its head, puffs its hood and lazily sways to the sibilancies. Charming performances are so common in various foreign countries that the natives and their children are by now accustomed to its sights, and they have also acquired an entirely different attitude toward reptiles in general. In fact, this difference in attitude can be almost regarded as a dividing line between Occident and Orient. Where most of our children are scared to death of snakes or at least they are repulsive to them and they will put up a brave front when they may find themselves close to them, the Oriental

child is in most instances not afraid of even a Cobra. In fact, a fitting test of bravery is for a child to play the Cobra a tune while the parents and others look on. In many instances the "snake charmer" is possessed with a thorough knowledge of snakes, being familiar with their important characteristics and methods of handling, so that in few instances one will find that the snakes have not been defanged. In few instances, one may find that a Snake Charmer may have submitted himself to graduated inoculations of the venom from the same species of snake with which he is working, so that by producing antivenin in his system, he may remain immune for a given interval of time and therefore even if bitten, he will show no outward effects. It is not an infrequent occurrence, however, to find that in many instances the snakes have had their fangs removed. This does not of course render such snakes entirely harmless. The poison still flows from the wounds remaining by the extraction of the fangs, but the likelihood is that snakes not containing the latter won't bite, and if they do, such poisonous venom will not gain access into the circulation unless some lacerations or cuts were produced. If it is desired to make the snake permanently harmless, the entire poison apparatus is removed by peeling the plate of the bone. The teeth and glands are fastened from the roof of the mouth to the latter. The swaying of the snake's body is not due to any interest in the music, but is due to the fact that the performer sways his body to keep in time with the music and the snake sways in a similar manner, altering its position to be always in aim to strike its aggressor. The snake in all probability does not hear the sound and yet as indicated appears to be affected by the vibration.

SNAKE DANCE This is a dance of a religious character performed by the Moqui Hopi Indians in Arizona. The dance is said to have been performed by this tribe of Indians, in the same manner and in the same place, ever since the middle of the sixteenth century. The rite includes the bearing of as many as 100 live snakes in the dance and each of these is borne by the dancers while dancing. Toward the end of the dance the snakes are carried in armfuls by the Indian men, and placed on the ground within a circle of sacred meal in front of a sacred rock. Here to the accompaniment of prayers and chants the serpents are sprinkled with the sacred cornmeal until the whole writhing, wriggling mass is completely covered by the meal. The dance concludes by the Indian men grasping each

as many snakes as he can hold and dashing down a steep incline at top speed. At its foot the snakes are liberated and scattered in every direction.

An interesting and detailed account giving also a summary statement of previous accounts of Hopi Snake Ceremonies is to be found in the Anthropological Series (Publication 66, Vol. III, No. 3), of the Field Columbian Museum, in which Dr. George A. Dorsey and H. R. Voth relate their experience during the witnessing of the performance of these rituals in one of the Hopi villages. Scientists who have been present at snake dances given by the Hopi Indians of Arizona speak of their fearlessness in the handling of rattlesnakes, from which neither the fangs nor the poison glands are removed. There appears to be no natural immunity among these Indians to the rattlesnake venom, and though they lay remarkable claims to the antidotal value of a decoction made from the stems and leaves of a plant (which is only known to few of the natives and kept a secret), the latter from scientific experiments recently conducted does not seem to possess the value claimed for it.

ENEMIES OF SNAKES

In the jungle, where snakes multiply rapidly, they are kept down by natural enemies, most of which are not to be found in inhabited areas, where man upsets the balance of nature. It is these natural enemies which aid in keeping the proper balance of life.

Man is in reality the snake's arch enemy. [illegible] environments where humans settle, road-building, together with the motor car, account for the death of many thousands of snakes. [illegible] vehicles usually run over the snakes as they wander to the roadway coaxed there by the rays of the sun. In the general operation of agriculture we find other factors contributing to the death of many more. Thus we have the mower, binder, disc and plow and other modern farm implements used in the fields, killing off reptiles. The burning off of stubble and brush and the draining and cultivating of low lands aid to diminish the numbers of snakes. In addition to this, there are entirely too many farmers, hikers, and in fact, most all humans who in the foolish prejudice against harmless and frequently useful reptiles seem to think that the only kind of snake worthwhile viewing is a dead snake with the result that every snake as soon as observed is killed by any type of an implement which may be at hand. Aside from man and indirectly the implements he employs in his operations, the greatest foe

of snakes is the snake itself, as many species are cannibalistic. The great King Cobra feeds entirely upon snakes, but is itself more dangerous than any he might destroy. However, the king snake and its allies in our country and the musurana in Brazil devour poisonous snakes, they themselves being harmless and inoffensive. Then we have the red-tailed hawk, known also as the big hen-hawk, the skunks, and probably pigs. It is said that domestic animals as dogs and cats can be taught to kill snakes. In addition to the mongoose, the European hedgehog and some of the large ground cuckoos, certain birds prey on snakes, usually the harmless variety. The cursorial hawk, the secretary bird of South Africa, the honey buzzard, some heavy-billed storks and ibises, the emu and the jaburi eat snakes. Certain spiders, toads and frogs devour snakes. It is interesting to see the toad eat a snake as it crawls along, for the toad will only eat moving objects.

(*To be Continued*)

IRRADIATED ERGOSTEROL, THE MODERN ANTIRACHITIC PRINCIPLE

By Frederick W. Greenbaum, D. Sc., Philadelphia, Pa.

ROSENHEIM AND WEBSTER [1] found that cholesterol was rendered antirachitic by exposure to ultraviolet rays. At the same time, independently of these investigators, Steenbock and Black [2] and Hess Weinstock and Sherman [3] made this same discovery. Numerous investigators have since confirmed these findings hence irradiated chloresterol and irradiated brain substance have since been used, and are up to the present time, in the treatment of rickets.

Rosenheim and Webster [4] showed, however, that cholesterol, when purified by a chemical method, lost the property of becoming antirachitic by irradiation and it was also shown that chemically purified cholesterol no longer possesses the absorption spectrum in the ultra violet region, which is characteristic of cholesterol purified by chemical means only. Rosenheim and Webster [5] pointed out that sunlight renders cholesterol antirachitic. A more stable, activated cholesterol is obtained by irradiating the substance in the absence of oxygen, both the secondary alcoholic group and the unsaturated carbon linkage of the sterol must remain intact under the influence of violet light; only sterols occurring in animals or plant tissues can be activated.

Cholesterol then, if highly purified by chemical means, loses its antirachitic activity after being irradiated, therefore, it is evident to conclude that there must be an impurity in cholesterol, which on irradiation is the antirachitic principle. It is interesting to mention that Steenbock and Black [2] and Schultz and Morse [6] as early as 1925 pointed out that an impurity in cholesterol may be responsible for the antirachitic action after irradiation.

This impurity occurs in cholesterol only in minute quantities, $\frac{1}{25}$ to $\frac{1}{40}$ per cent. of the cholesterol, which accounts for the fact that its discovery has so long escaped the chemists. This impurity was a sterol, which was known before under the name of ergosterol; ergosterol was originally isolated from ergot by Tanret [7] and was named accordingly. Ergosterol is also found in yeast, mushrooms, in many other lower plants and in certain vegetable oils.

As to the preparation, there are various methods of extracting from ergot and from yeast. A far greater amount of ergosterol is contained in yeast and, therefore, the methods of today are to use yeast as a starting material. I. Smedley McLean and E. M. Thomas [8] described at first the saponification of yeast fat, then the saponification of this yeast fat and the extraction of the unsaponified matter with ether. This ethereal extract contained the ergosterol and repeated crystallization from alcohol gave crystals of a sterol with a melting point of 154 C., which seems to be identical with the ergosterol isolated from ergot by Tanert.[7] The yeast sterol, when first isolated, melted at 135-136° C. and many crystallizations were necessary to bring the melting point up to 154° C. Solutions of yeast sterol become yellow and decompose slightly on standing, even on standing at ordinary temperature a yellow oily substance is formed. M. Windhaus and W. Grosskopf [9] prepared ergosterol from yeast by combining the extraction and saponification of the yeast fat in one operation. This was carried out by digesting the yeast in alcohol, adding potassium hydroxide solution and additional alcohol to it and heating this mixture on a water bath for three hours. Then filtering off, the residue extracted once more with hot alcohol, the combined alcohol brought to half its volume by distillation, then adding an equal volume of water and extracting thoroughly with ether in a separatory funnel. The ether extract was then dried with anhydrous sodium sulphate and the ether removed by distillation. A light yellow oil remained, which smelled somewhat like honey, and on standing congealed to a mesh of crystals. These were dissolved in boiling petroleum ether and the

solution placed in a cooling mixture. After a short time a white precipitate crystallized, which was filtered and washed with cool petroleum ether. This crude ergosterol had a melting point of 141-142° C. and after repeated recrystallizations from alcohol the melting point was raised to 154° C. The crystals are fine, silver shining leaflets, which must be protected from light and air. From 10 kilos of yeast 15 g. of ergosterol were obtained.

The author, in his experience in preparing ergosterol, found the method of Windhaus and Grosskopf to be much simpler than Smedley and McLean's method and more suitable for the preparation of ergosterol on a larger scale. At a recent convention of the German Chemical Society in Dresden, Germany, Professor Heiduschka [10] reported on the ergosterol content of various yeasts and pointed out that the method of Windhaus and Grosskopf has been further simplified by avoiding the ether extraction. Heilbron, Kamm and Morton [11] studied the absorption spectra of oils and oil constituents with special reference to ergosterol. They pointed out, as other investigators already had, that the reaction ergosterol + light → Vitamin D is accompanied by the appearance of a new band at 247$\mu\mu$, which in all probability is characteristic of the vitamin. Unfortunately a very considerable concentration of pure vitamin of the order of 0.01 g. per 100 cc. of alcohol is necessary to secure the detection of the absorption band, so that this spectroscopic test cannot serve as a criterion of the absence or presence of the antirachitic vitamin. The authors investigated, by means of this absorption band at 247$\mu\mu$, other oils for their ergosterol content and found that cottonseed oil contained from 0.75 to 2.5 per cent. ergosterol, so that cottonseed oil may be used as a new source for the preparation of ergosterol. Sesame, peanut and olive oils do not contain ergosterol; yeast fat contains as much as 40 per cent. ergosterol; ground nut oil contains varying amounts—from zero to small amounts of ergosterol; linseed oil and maize oil contain small amounts of ergosterol.

Chemically, ergosterol is an unsaturated alcohol, possessing three double bonds and a secondary alcoholic group. Its brutto formula is $C_{27}H_{42}O$. H_2O. Cholesterol which has the brutto formula $C_{27}H_{46}O$ is a mono atomic alcohol, which occurs in combination with various fatty acids in lanolin—purified fat of sheep's wool. Ergosterol has an iodine value of 177.1 (Huebl). Cholesterol in chloroform solution gives a red color with concentrated sulphuric acid, while ergosterol remains colorless. Cholesterol has a melting point of 135-136° C.,

while ergosterol when pure has a melting point of 154° C. and according to Bills and Honeywell even 168-183° C.[11a]

When ergosterol is exposed to ultra violet light a chemical change takes place, transforming the ergosterol into a new substance, the chemical composition, which is as yet unknown, but which, due to the absorption spectrum and its antirachitic behavior, is identical with Vitamin D obtained from other sources. In this irradiation the source of the ultra violet rays and the time of exposure to them are of utmost importance. Hottinger [12] found that the optimum time is twelve hours and that after twelve hours' exposure an antirachitic product is obtained, of which 1/100,000,000 g. prevents the appearance of rickets in rats which are put on a ricket-producing diet. The biological optimum corresponds to a certain change in the absorption spectrum and the disappearance of the precipitation of ergosterol with digitonin. It is interesting to point out in this respect that overexposure destroys the antirachitic activity of the irradiated substance. This activation of ergosterol is carried out in an organic solvent, such as ethylalcohol, liquid paraffin or vegetable oils. As already mentioned, ergosterol can be precipitated just as cholesterol with digitonin, it turns the polarization plane strongly to the left and it shows absorption of the transmitted ultra violet light in the region of 2800 A. units. After irradiation the substance loses completely the property of being precipitated with digitonin. The newly formed substance turns the polarization plane distinctly to the right, but, on further exposure to the ultra violet rays, the polarization gradually decreases. The absorption of 2800 A. units at first increases then decreases to 2500 A. units. The end product of the irradiation does not show any absorption and is not effective in rickets. F. Holz [13] pointed out that the velocity of transformation depends upon the thickness of the exposed layer and the concentration of the solution as well as the intensity of the absorbed rays. The first transformation product is formed in a few minutes, while for the "overexposure" of ergosterol to the unactive final product several days are required. Holz tried to carry out the activation of ergosterol by means of the visible light, using sensibilizators as energy transformers. He did not, however, in this way obtain substances which were antirachitic, but he established two reactions—photo oxidation in the presence of air and photo dehydration in the absence of air.

An alcoholic solution of ergosterol to which was added eosin, erythrosin, or etc., to the extent of 0.1 per cent. of the weight of the

ergosterol, was exposed in glass vessels to sunlight or artificial light; a precipitate was obtained, which as a peroxyde of this ergosterol, of the formula $C_{27}H_{42}O_3$ was entirely unactive in rickets. On reduction with sodium ethylate this peroxide again gave ergosterol, which on irradiation with ultra violet light, was transformed into Vitamin D.

The photo dehydration was carried out by exposure of the alcoholic solution of ergosterol, containing eosin, erythrosin, or etc., in the absence of air, to sunlight or artificial light. The dye disappeared, was bleached, or chemically speaking, reduced to the colorless leuco base; the ergosterol was transformed into a very difficult soluble substance, which was precipitated. This reaction product contained two hydroxyl groups; most likely the ergosterol was reduced to the keton and the dye took up the liberated hydrogen and the keton condensed with unchanged ergosterol to the pinekon.

The most interesting experiments of F. Holz [13] show clearly that the exposure of ergosterol, in the presence or absence of air, to sunlight or artificial light will result in the formation of Vitamin D and will produce substances chemically related to ergosterol but inactive in rickets and only the exposure to ultra violet rays will produce Vitamin D.

A considerable amount of work has been done on the activation of ergosterol with ultra violet rays, particularly in the University of Wisconsin. Fosbinder, Daniels and Steenbock [14] and Kazimierz Kon, Daniels and Steenbock [15] have studied the action of monochromatic light on cholesterol and have quantitatively studied the photo-chemical activation of sterols in the cure of rickets; they used the 265 mu. line of the mercury arc. This was the outcome of a study of Dr. Vanselow, in which all the important lines of the quartz mercury lamp were studied under a variety of conditions. All experimental evidence now available points to the conclusion that ergosterol is the mother substance of Vitamin D. Windhaus working in collaboration with Rosenheim,[16] Hess [17] and Pohl [18] found that ergosterol can be rendered active in much smaller amounts than cholesterol and it shows the same absorption band as the activatable impurity in cholesterol. In contradiction to the conception of previous workers that ergosterol, the impurity in cholesterol, is the mother substance of Vitamin D, a different point of view is held by Bills, Honeywell and McNair [19] and Jendrassik and Kenenyffi.[20] These investigators assumed an equilibrium between pure cholesterol and ergosterol. They used cholesterol purified by two or three times bromination and found that after irra-

diation for fifteen minutes, in the solid state, positive results in feeding tests were obtained. Kasimierz Kon, and Daniels and Steenbock both confirmed these findings. The ergosterol lines were still visible in the purified cholesterol; it showed three absorption bands identified with ergosterol and two additional ones at 315 and 304 mu. The ergosterol bands were one hundred fifty times weaker after purification, but the curative effect was only thirty times weaker. Heilbron, Morton and Sexton [21] believe that these new bands of absorption are due to cholesterilene formed in the course of oxidation. The presence of various oxidation products, absorbing ultra violet light, is undoubtedly true.

Kasimierz, Daniels and Steenbock [15] purified cholesterol by means of potassium permangante and the so obtained highly purified cholesterol (m. p. 147° C.) was irradiated, but proved entirely inactive, which proved, without doubt, that pure cholesterol cannot be rendered antirachitic by ultra violet irradiation and that ergosterol is at present the only substance which is specifically activated by radiant energy. They also found that the quantity of radiant energy necessary to form an amount of Vitamin D, sufficient to cause deposition of calcium in the bones of a rachitic rat, is from 700-1000 ergs for the 256, 265, 280 and 293 mu. lines. This quantum efficiency was independent of the state in which the ergosterol was irradiated; the solid ergosterol and the solutions of various concentrations of ergosterol gave the same results. The quantum efficiency was the same for ergosterol-acetate as for ergosterol. The hydroxyl group plays no role in the process of activation.

Hottinger,[12] as mentioned above, found the optimum time for irradiation to be twelve hours, R. A. Morton, I. M. Heilbron and E. D. Kamm [22] found, through a study of the absorption spectrum of ergosterol in alcoholic solution, as a function of the time it had been irradiated with the quartz mercury lamp, that the exposure from ninety minutes to one hundred fifty minutes produced the best results and that after six hours' exposure the antirachitic band of 247 mu. disappeared. They, therefore, suggested in the large scale production of Vitamin D, the destructive wave length near 247 mu. should be screened off.

Irradiated ergosterol has become the modern treatment for rickets. This discovery has explained the beneficial action of cod liver oil and of the mercury arc lamp treatment in rickets. Cod liver oil apparently contains the antirachitic vitamin and the mercury arc

lamp treatment produces protective substances in the human body, which will prevent the formation of rickets.

The dosage required for cure or prevention of rickets is so minute that it can be easily given to infants as a prophylactic. Otto Rosenheim and Thomas A. Webster [16] recommend daily doses of 1/10,000 milligrams, which will cure and prevent rickets in rats on a rachitogenic diet. A. Hottinger [12] investigated the action of ergosterol on dogs and found it to be very active. He then used it in infants, children and adults. He recommended as a dose for infants one milligram per day, for babies of two to three years of age two to three milligrams per day and for adults five milligrams per day. H. Strote [23] found that irradiated ergosterol will give beneficial effects in cases of rickets, osteomalacia with fibromatosis and infantile tetany. He recommended doses of one to two milligrams.

C. I. Urechia and G. Popovicin [24] demonstrated that irradiated ergosterol does not influence the metabolism of dogs in which tetanus was produced by parathyroidectomy. No increase in the blood calcium or phosphorus was obtained and ergosterol did not prolong the life of these animals. A. F. Hess [25] studied the behavior of irradiated cholesterol, ergosterol and allied substances and found that the most practical application of irradiated food is the use of an irradiated dried milk for infant feeding. This food prevents or cures rickets and tetany and maintains its specific activity for at least six months. Irradiated cholesterol and irradiated dried brain were used successfully. The activity of irradiated cholesterol is probably due to the contaminating sterol. Ergosterol prepared from yeast brought about calcification of the epiphyses, when as little as 0.002 milligrams was fed daily to rachitic rats. This is the smallest amount of any vitamin, which was found to exert a specific action. Irradiated yeast in itself is highly effective as an antirachitic in animals and in infants. P. Gyoergy [26] recommended in his experiments doses of 2-4 milligrams of irradiated ergosterol per day to cure a child of rickets and the same dosage is recommended by G. Prinke.[27] H. Benner [28] fed to a premature baby 0.1 g. portions on four successive days; then the stools were analyzed for ergosterol and only 147 milligrams were recovered. The excretion had stopped three days after the last administration. The compound was either destroyed by bacterial action in the intestine, catabolized in the body or stored. Experiments were not performed to ascertain how the sterol was lost. A very interesting application of ergosterol was reported by E. Bors.[29] The Germans put irradiated

ergosterol on the market under the name of "Vigantol," and this, as shown by Bors, in experiments on white rats, seems to have a healing action on fractures and it is to be hoped that Vigantol will possess a healing action on fractures in human beings. H. Benner [30] showed that 5 milligrams of irradiated ergosterol correspond to 5 liters of good cod liver oil. Windhaus has already shown that the irradiation of digitaligenin will produce a rachitic active substance, which proves active up to 2/1000 milligrams in experiments with rats. This exceedingly interesting fact shows that besides the ergosterol other chemically related substances will obtain vitamin character on irradiation and, therefore, the vitamin action is not limited to one certain substance, a finding which is in distinct opposition to the results of Kazimierz Kon, Daniels and Steenbock [15] mentioned above. The vitamin action, however, is limited to a special light sensitive steric configuration of the molecule. Stoeltzner [31] made the very interesting observation that yellow phosphorus is able to activate ergosterol, which according to him explains the better action of phosphorus cod liver oil, as compared to cod liver oil without phosphorus.

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THE GERMAN PHARMACOPŒIA. VI

("Deutsches Arzneibuch, 6. Ausgabe 1926")

FOLLOWING the suggestion of the Executive Committee that general articles from recent foreign pharmacopœias be translated and published in the Official Circulars of the U. S. P. Revision Committee for the benefit of both the present and the next Committee of Revision, the General Rules of the German Pharmacopœia, Sixth, are herewith submitted.

A comparison of the standard methods for determining physical constants taken from leading National pharmacopœias should materially assist another revision both in technique and in arriving at closer international uniformity. Those who are responsible for a new revision will be provided with such comparison.

GENERAL RULES OF THE GERMAN PHARMACOPŒIA

General Regulations for the Writing of Formulas

In ring formulas the linkage is indicated by a dash (—); in compounds of an open chain by a dot (.).

Hydroxyl and amino-groups are linked with the radical by a dot (.).

Acid radicals linked to nitrogen are in brackets. Salts of organic bases, have the formula of the base in parenthesis and the formula of the acid added without a dot (.).

The carboxyl group is written CO_2H.

Crystal water is connected with a formula by the sign +.

General Technical Explanations

1. "Parts" of solids are always by weight. Per cent. is also by weight.

2. "Water," distilled water.

3. Solutions are always aqueous unless otherwise stated.

4. In directions for preparing solutions of definite strength the terms "1 + 9," "1 + 19," mean that one part of the substance is to be dissolved in 9 parts of the solvent or 1 part in 19 parts of the solvent.

5. The figures given for solubility do not represent minutely accurate amounts, but are adequate for the needs of the druggist. A statement that a substance is insoluble, is conventional.

6. For residues remaining after evaporation or ignition, figures are given. If the quantity is below 0.001 gm. the residue is considered negligible or unweighable.

7. Statements in regard to density refer, if not otherwise stated, to 20° C. The density thereby means the relation of the mass of a given volume of the fluid at 20° C. to the mass of distilled water at 4° C., so that it represents a quotient of the density of the fluid at 20° C. divided by the density of water at 4° C. The density figures also indicate how much 1 gm. or 1 cc. of fluid of 20° C. would weigh in vacuum. The calculation is based upon the formula:

$$d = \frac{m}{w} \cdot 0.99703 + 0.0012$$

whereby d = the density, m, the weight of the fluid which should be determined, and w, the weight of the same volume of water at 20° C. in air.

A table of densities from 10° to 25° C. is given in appendix V, and a table for the density of fluids at 15° C. based upon the density of water at 15° for the unit (specific gravity of the *German Pharmacopœia,* 5th edition) in appendix VI.

Statements of temperature refer to a centesimal thermometer. If no other temperature is specified, 20° C. is understood. Room temperature is from 15° C. to 20° C. Only officially tested and certified thermometers should be used.

For the testing of fundamental points on the thermometer that may change in time by the expansion of the glass, the procedure given under 29b for the determination of the boiling point of distilled water may be followed. If t_6 is the indicated boiling point, $\frac{t}{w}$ the real boiling point corresponding to the barometric pressure, then for all readings, the value $(t_w - t_6)$ must be added or subtracted. If necessary the zero point of the thermometer may be tested by immersing in melting ice.

The thermometer is immersed in water, with finely chopped ice, and after stirring and tapping the mixture with the thermometer until constant temperature is reached the reading made. Care should be taken that the thermometer is immersed to the zero point.

If no special statements are made for aqueous solutions, the term "cold temperature" means from 15°–20° C., "warm temperature" from 50°–60° C., and "hot temperatures" above 80° C.

9. A "water bath" means, if no special temperature of the water is given, a bath of boiling water. Instead of this a bath heated with steam about 100° C. may be used.

10. Data in regard to polarization refer to sodium light and to a temperature of 20° C. unless otherwise stated. In the case of ethereal oils the polarization is read directly in a 100-mm. tube $a_D 20°$. In the case of camphor, scopolaminohydrobromide, sugar and other specific rotation is measured $[a]_{D20°}$.

11. Microscopic measurements are in μ. $1\mu = 0.001$ mm. The absolute value of a division on an ocular micrometer is to be determined for each magnification by a stage micrometer. For observations with a magnifying glass, one with a six times magnification is generally used.

12. A measure for reducing substances is determined in the following way:

Crudely cut drugs separated by means of a sieve (4-mm mesh ($W° = 1.$).

Medium, finely cut drugs, separated by means of a sieve (mesh 3 mm. ($W° = 2$).

Finely cut drugs separated by means of a sieve (2-mm. mesh) ($W° = 3$).

Coarsely powdered drugs separated by means of a sieve of about 0.75 mesh ($W° = 4.$).

Medium finely powdered drugs separated by means of a sieve of about 0.30 mesh ($W° = 5$). Finely powdered drugs separated by means of a sieve of 0.15-mm mesh ($W° = 6.$).

In cutting the drugs the fine particles must be eliminated if the drugs are to be sold as "crudely cut" ones, or are to be used in mixtures of tea. If, however, the drugs are to be used for extraction with solvents, the finer particles should be retained. For powdering drugs to different degree of fineness, it is important to bring them down to the prescribed mesh, the finer part, however, should not be separated.

13. The action of some drugs, *e. g.*, a white clay and medicinal carbon, is due to the fact that they adsorb substances. By suitable experimental methods their power of adsorption should be tested.

14. To count the drops, the normal drop counter as agreed to in the Brussels arrangements is used, which is assumed to furnish 20 drops of distilled water weighing 1 gm. at 15° C.

15. A "Kassia" flask specified for testing ethereal oils is a flat-bottomed flask of 100 cc. content with a long neck of 0.8 cm. inner width and about 16 cm. of length, which is subdivided in 0.1 cm. An acetylation flask is egg-shaped about 100 cm. content, supplied with a condenser connected by a ground joint.

16. In preparing extracts, infusions, ointments, tinctures and the like, the general directions are given for such work in a special article which should be followed except when otherwise stated.

17. For sterilization the following rules should be observed Disinfection means to bring an object to a state in which it can no longer infect.

Sterilization is to be carried out according to bacteriological technique. It is essential that the hands, cloth (working coat) and instruments, particularly towels and working tables, should be absolutely clean. An object is sterile when free from all living micro-organisms (vegetative and permanent forms). Sterilization must be

carried out by either direct heating, heating in hot air, boiling in water, treatment with live or superheated steam or by germicides according to the nature of the material.

The duration of the heating is calculated from the time in which the material has assumed the right temperature.

Glass, porcelain and metals, particularly pharmaceutic glasses, funnels, dishes, mortars, are sterilized by heating in an air-drying oven at about 160° C., or in live steam, or for 15 minutes in an autoclave at 115° C. Boiling for one-half hour with 1 per cent. sodium carbonate solution may be used; in which case rinsing with sterile water is necessary.

Rubber objects and rubber stoppers are boiled for one-half an hour in water or sodium carbonate solution. In the latter case, rinsing with water is necessary.

Gauze is treated for 15 minutes in superheated steam about 115° C. or with live steam for 30 minutes, the duration of the heating being counted from the time when the object has reached the required temperature. Gauze must be placed in a wrapping, which allows the steam to penetrate, but on the other hand, prevents subsequent contamination with germs.

Filter papers are sterilized like gauze. Water and solutions, not changed by heating, are to be kept for 30 minutes at 100° C. or heated in an autoclave at 115° C. for 15 minutes. Glycerin, fatty substances, oils and liquid paraffin are heated for 2 hours to 120° C.

Powdered drugs, such as white clay and zinc oxide, are to be heated for 2 hours in a drying oven and allowed to cool in covered dishes. The duration of the heating is calculated from the time when the interior of the powder has reached the required temperature. Powdered drugs, which change on heating, are to be moistened with ethyl alcohol and dried at a temperature not higher than 60° C.

Liquids and solutions liable to change by the above methods are freed from germs by fractional sterilization carried out by exposing the materials for at least four succeeding days for 40–60 minutes to a temperature of 70 to 80° C. and in the intervals keeping them at 30° C.

Fluids and solutions that are changed by this method can only be sterilized under special precautions by filtration through sterilized filtering cylinders. In this way they may be freed almost completely from germs. Fluids and solutions, which are treated by either frac-

tional sterilization or by filtering through filter cylinders, cannot be considered entirely sterilized.

Emulsions, suspensions and digestions of powdered drugs with glycerin, fats and oils, liquid paraffin as well as solutions that changed at temperatures from 70–80° C. and that cannot be made free from germs by filtration through filtering tubes, should be treated according to the rules relating to aseptic preparation of drugs, if a regular sterilization on account of certain constituents is not possible. In this case the drugs necessary for the preparation should be sterilized individually. Sterilized instruments and dishes should be used and should be filled up in sterilized containers. If sterilization of the instruments is not possible, they should be cleaned with sterilized cotton and ethyl alcohol.

Preparations made in this (aseptic) way, cannot be called absolutely sterile.

Testing Methods

The testing of drugs is to be carried out on average samples, which are prepared by thorough mixing of the total quantity thereof.

19. Chemical tests, if nothing else is specified, are to be carried out in test tubes, about 15-mm. width. If not otherwise stated, 5 cc. of the liquid to be tested should be used. The content of the test tube must be viewed from above through the entire depth of fluids.

20. For the definition of the terms "opalescence," "opalescent turbidity" and "turbidity," the following statements are important:

(a) Opalescence is the highest degree of turbidity which is produced when 5 cc. of a mixture of 1 cc. N/100 hydrochloric acid and 99 cc. of water are mixed with 0.5 cc. of N/10 silver nitrate solution. The observation should be made 5 minutes after the addition of the silver nitrate solution against a dark background by reflected light.

(b) Opalescent turbidity is the optimum degree of turbidity, produced if 5 cc. of a mixture of 2 cc. of N/100 hydrochloric acid and 98 cc. of water are mixed with 0.5 cc. of N/10 silver nitrate solution. The observation is made as mentioned under (a).

(c) Turbidity is the optimum degree of turbidity which is formed when 5 cc. of a mixture of 4 cc. of N/100 hydrochloric acid and 96 cc. of water are mixed with 0.5 cc. of N/10 silver nitrate solution. The observation should be carried out as mentioned under (a).

21. Volumetric solutions are to be tested before use for their titer according to the directions given in Appendix II. The factor

(f), calculated according to directions, indicates the number of cc. of a solution of an exact content, normal, N/2, N/10, or N/100, which correspond to 1 cc. The factor and the date is put on the stock bottle. The number of cc. used in volumetric determinations is multiplied by this factor, whereby the number of cc. of the titration fluid is obtained, the content of which should be the exact specified one (normal N/2, N/10, or N/100).

If a definite number of cc. of an exactly normal, N/2, N/10, or N/100 solution is used (for instance, if the excess of the solution is to be titrated back), then in using a solution not containing exactly the prescribed number of cc. these have to be multiplied by 1/F to obtain the required number of cc. for this normal solution (F = factor).

22. In volumetric determinations officially tested and certified, volumetric apparatus must be used.

The following rules in the use of measuring vessels should be observed:

1. All dishes must be clean. Dishes, which allow drops to adhere to the surface are to be considered as dirty and also if on pouring in fluids a meniscus is formed even indistinctly. These dishes can be cleaned by soap solution, with alcoholic potassium hydroxide or a solution of one part of potassium bichromate in 10 parts of moderately diluted sulphuric acid.

2. In using flasks and measuring vessels, the lower brim of the meniscus of the liquid should coincide with the mark.

3. In burettes and pipettes the fluid is allowed to rise about 1 cc. above the upper ring mark and then by withdrawing the liquid, it is adjusted to this mark. For allowing the liquid to drain, special precautions have to be taken:

(a) Transfer pipettes with a mark are kept vertically and the fluid being allowed to drain completely into a container so that the tip of the pipettes rests on the wall of the container. If the pipette ceases to drain, after waiting for about 15 seconds, the tip is touched to the side of the vessel.

(b) Burettes are allowed to drain with opened stop-cock into a receiving vessel. In titrating fluids, the reading is made as soon as the titration is finished. If, however, a certain definite amount of normal solution is to be put into a vessel, the draining should be stopped as soon as the liquid has reached about 5 mm. above the final mark. After about 30 seconds, or the time specified on the burette,

the fluid is then adjusted to the mark and the tip of the burette touched to the side of the vessel.

(c) With measuring pipettes the tip is laid on the wall of the dish and the flow of the liquid interrupted as soon as it has reached 5 mm. above the end mark, then after 15 seconds adjusted to the final mark.

(d) When liquids should be read to an accuracy exceeding 0.1 cc. special burettes must be used. Such a burette is 60 mm. length, containing 10 cc. of liquid, the scale being graduated 1/50 cc. The tip of the burette must be adjusted so that 40 drops of water correspond to 1 cc.

23. If, for volumetric determinations, substances are to be dissolved in ethyl alcohol or ether, these solvents are to be neutralized with the same indicator used for the determination.

24. For determination of the content of the drugs, as long as nothing else is specified, they are to be used in air-dried condition. This is true for the whole drugs as well as for cut or powdered samples.

25. For the examination of drugs, the following rules should be observed:

(a) Such terms as glycerin preparation, chloral hydrate preparation, etc., mean that fine cross-sections of these, or small quantities of the powders, in glycerin or chloral hydrate solution, are to be put on the slide and covered with a cover glass.

(b) Microsublimation is carried out as follows:

A few small pieces of the drug cut by means of scissors or knife or a few milligrams of the powder are placed on the slide, which is placed on an asbestos wire gauze. On one end of the slide, one or more small pieces of glass are placed, covered with a second slide, so that the latter rests with one end upon the small pieces of glass and the other on the lower slide. The under side must be one millimeter above the preparation. The heating is done by a micro-burner, the flame of which is about 1 cm. long. The tip of the flame is about 7 cm. below the asbestos mat. The slide on which the sublimate collects should be exchanged for a second after one to two minutes, and such exchange continued until no more sublimate collects. Examination of the sublimate should be made at once and also after an interval of twenty-four hours.

(c) Microdistillation is conducted by using a small dish with a watch-glass cover and resting on asbestos gauze. The heating is to be done cautiously as in microsublimation. The watch-glass is placed with the convex side down so that water for condensing may be placed in the concave side. The distillate will collect in hanging drops on the under side of the glass and can be transferred to a slide if desired.

26. Determination of ethereal oils is made as follows.

In the absence of directions otherwise, 10 gm. of the coarsely powdered samples are placed in a round-bottomed flask of about 1000 cc. capacity, with 300 cc. of water, and a few fragments of pumice or similar material to prevent bumping. These fragments should have been cleaned with hydrochloric acid and rinsed with water. A delivery tube about 30 cm. long, bent twice at a right angle, is connected with the flask and then to a vertical condenser having a tube of 55 cm. and a jacket 22 cm. long. The distillation is carried on with a fairly powerful burner, the flask being protected by an asbestos gauze. The receiver is either a flask or separatory funnel of 300 cc. capacity. The points of 150 cc. and 200 cc. must be marked. When 150 cc. has passed over, the heat is from time to time removed for a moment, and when the boiling ceases, the distilling flask is carefully shaken in order to wash into the liquid any fragments of the drug that may be adhering to the walls. The liquid is again heated to boiling and distilled until 50 cc. have passed over. During the procedure it may be necessary to interrupt occasionally the flow of cooling water if the condensing tube shows turbidity due to drops of oil. Such interruption must continue only until the turbidity disappears. The condensing tube must not dip into the distillate. The distillate amounting to 200 cc. is put in a separatory funnel, 60 gm. of sodium chloride added and the solution extracted three times with 20 cc. of pentane for each extraction. The mixed extractions are allowed to stand for several minutes, transferred to a weighed wide-necked flask of 100 cc. capacity, care being taken that no drops of the salt solution enter the flask. The pentane is distilled off on a gently heated water bath. The last traces of the solvent are removed by carefully blowing dry air through the flask, which is put into a desiccator for half an hour and weighed. After allowing it to stand for another quarter of an hour in the desiccator, the loss in weight should only amount to a few milligrams. If this is not the case, then the flask should be left in the desiccator, until the difference in weight obtained in quarter-hour periods is not more than 0.002 gm.

27. Determination of the Melting Point.

(a) With all substances except of fats and fat-like compounds, if not otherwise stated, the determination of the melting point is carried out in a thin glass tube closed at one end of about 1 mm. in diameter. In this tube the powder, dried for 24 hours in a desiccator, is introduced so that after tapping on the bottom of the tube a layer of 2–3 mm. is formed. The tube is attached to a thermometer in such a way that the substance is at the same level with the mercury bulb. The combination is immersed in a test tube 15 mm. diameter and 30 cm. long, holding a layer of sulphuric acid about 5 cm. deep. The upper end of the melting-point tube must be above the acid. The test tube is inserted in a round flask, with a neck about 3 cm. wide and 20 cm. long and the content of the bulb about 80–100 cc. Enough acid is placed in to fill about two-thirds of the neck after immersion of the test tube. The acid is heated and the temperature being slowly increased beginning 10° C. below the presumed melting point, so that for an increase of one degree at least half a minute is required. The temperature at which the substance becomes transparent and collects at the bottom of the tube as transparent drops, is the melting point.

(b) Determination of melting point of fatty substances is carried out in a thin glass tube about 1 mm. diameter, open on both ends. The fat is introduced so that it forms a layer about 1 cm. high on the bottom of the tube. If molten fat, previously melted, is used, the tube is allowed to remain at low temperature (10° C.) for 24 hours tc insure complete congealing. The tube is connected with a thermometer and immersed in a test tube 30 mm. diameter, containing water. The heating is carried out gradually with frequent stirring of the water. That temperature at which the column of fat becomes transparent is the melting point.

28. Determination of solidifying point. Ten gm. of the substance are place in a test tube in which a thermometer is inserted and gently heated.

By immersion in water, the temperature of which is 5° below the presumed solidifying point, the melt is cooled to about 2° below the point, and by stirring with the thermometer, and if necessary, by dropping in a small crystal of the substance, it is caused to solidify. The highest temperature noted during the freezing is considered as the solidifying point.

29. Determination of the boiling point. The boiling point of a liquid is the temperature at which the vapor pressure is equal to the

atmospheric pressure. The boiling points mentioned in the text of the Pharmacopœia refer to a barometric pressure of 760 mm. mercury. In Appendix VII, a table with barometric pressure ranging from 650–800 mm. and the corresponding boiling points are given.

Two methods for the determination of the boiling point are available.

(a) If only the identity of a drug is to be determined, the apparatus described for determination of melting point under 27a is used, by attaching to the thermometer as described above, a thin-walled glass tube closed on one end of a diameter about 3 mm., and in this tube one to two drops of the liquid to be tested are placed and also a capillary tube immersed, so as to avoid delay of boiling. The procedure is exactly as in the determination of melting point. The temperature at which an uninterrupted series of bubbles begins to rise is the boiling point.

(b) If the degree of purity is to be determined, the substance should be distilled from the apparatus described here. As a suitable vessel either a boiling-point tube or flask can be used. A_1 is a thick-walled tube 180 mm. high, and 20 mm. wide. The flask A_2 is similar, but terminates in a bulb 5 cm. in diameter. To facilitate the escape of bubbles, pumice fragments or beads having diameters about 2.5 mm. and forming a layer about 2 cm. high, are placed in A_1. These materials should have been previously washed with hydrochloric acid and rinsed with water. About 15 cc. of the substance to be tested are introduced into A_1; to which is attached a fractionating column by a cork. It consists of an inner tube of 9 mm. wide and about 210 mm. high, the upper part of which is contained in a steam jacket about 20 mm. wide and 140 mm. long. The upper, somewhat narrow, end of the steam jacket is closed by a cork carrying a thermometer. At the lower end of the jacket is an outlet tube H of about 210 mm. long.

Determination for Fluids Boiling Below 100° C.

The tube A_1 is placed in the centre of an asbestos plate 100 mm. long which has a round opening in the centre about 20 mm. diameter. This is closed below by a brass wire gauze of 1 mm. mesh. The height of the flame should be regulated so that ether, for instance, is kept just boiling, other fluids by boiling vigorously. The outlet tube should be connected with a condenser.

Method for the Determination of Fluids Boiling Above 100° C.

The flask A_2 should be placed upon a brass wire gauze of about 3 mm. mesh. The height of the flame should be regulated so that after careful heating the fluids are brought to vigorous boiling. As soon as the first drops distil, the flame should be reduced smaller so that about 60 drops are distilled per minute. The outlet tube H. should be connected with a condenser. In these determinations almost the entire fluid must distil within the given temperature range. The first drops and the residual fraction should be very small.

The testing of liquids such as petroleum benzin, crude cresol, etc., with which within a certain temperature range definite quantities distil, the usual distillation flasks should be used. The heating for liquids that boil below 75° C. should be conducted on a water bath, in all other cases over a free flame with wire gauze.

30. Residue after incineration is determined in the following way:

A weighed amount of the substance is ashed in a previously heated and weighed crucible by means of a moderately strong flame. When difficultly combustible carbon is formed during the ignition, the flame is removed for a short time, to accelerate the combustion of the main portion of carbon. If, on further heating, a satisfactory burning of the carbon is not obtained, hot water is poured over the carbon and the entire content of the crucible is filtered through a filter of known ash content. The filter is washed with water, using as little water as possible, then put into the crucible together with the residue already there and again ignited. When the carbon has been burned off, the crucible is cooled, the filtrate and wash-water are re-evaporated in it to dryness on a water bath. The obtained residue is now moderately ignited for a short time and after cooling the crucible is weighed. The weight obtained, less that of the ashes of the filter, is the weight desired.

Ashing of drugs, if not otherwise stated, is accomplished as follows:

A porcelain crucible is filled about one-third with purified sand, ignited and weighed, after half an hour in the desiccator. The purification of the sand is done by digesting sea sand with hydrochloric acid, and washing with water; it is then dried and ignited. The substance to be ashed is placed in quantities from 0.5–2 gm. on the sand, then weighed and mixed with the sand with a glass rod or silver spatula, and finally cleaned off over the crucible with a feather. Com-

bustion is started with a very small flame, gradually increased. In most cases, combustion and ignition take place smoothly and quickly, which can be easily recognized by the color of the sand. If ignition is very slow, it should be allowed to cool, putting the crucible in an oblique position, gently tapping the content, part of the bottom is exposed and 5 to 10 drops of fuming nitric acid are placed upon this, the sand is returned to the horizontal and heated upon an asbestos plate over a very small flame until dry, then with a strong flame. The cooled content of the crucible is mixed with a little powdered oxalic acid, again ignited briefly and weighed after remaining for half an hour in the desiccator.

The sand can be used repeatedly for such determinations. Saffron should be charred at first with sand, cooled and the carbon and sand thoroughly mixed.

31. Determination of the degree of acidity "acid number," "saponification number" and "ester number."

(a) The degree of acidity of a fat or oil represents the number of cubic centimeters of a normal potassium hydroxide solution necessary to neutralize the free acid present in 100 gm.

To determine this, 5–10 gm. of the sample are dissolved in 30–40 cc. of an acid-free mixture of equal volumes of ether and absolute alcohol and then titrated with N/10 potassium hydroxide solution with 1 cc. of phenolphthalein. If during the titration part of the fat or oil is separated, a further addition of the alcohol-ether mixture must be made.

(b) Acid number indicates the number of milligrams of potassium hydroxide necessary to neutralize the free acid present in 1 gm. of wax, spermaceti, rosin or balsam. The determination is made out as described in the paragraph on the several substances.

(c) Saponification number is the number of milligrams of potassium hydroxide which are necessary to neutralize free acid in 1 gm. of fat or oil or wax or balsam and to saponify the esters. The amounts are to be weighed accurately.

Determination of the saponification number is carried out as follows unless otherwise specified:

One to two gm. of the substance are weighed into a flask of hard glass about 150 cc. content, 25 cc. of N/2 alcoholic potassium hydroxide are added, the flask closed with a cork with one hole, through which a tube of hard glass (as condenser) about 75 cm. long is inserted. The mixture is heated under frequent agitation on a water

bath and kept boiling for one-half hour, until it becomes entirely clear. To complete saponification, the content of the flask is mixed by repeated careful agitation, care should be taken that the fluid does not come in contact with the cork or with the condenser tube. Then the hot solution is titrated after addition of 1 cc. of phenolphthalein solution at once with N/2 hydrochloric acid, titrating the excess of potassium hydroxide (1 cc. N/2 HCl = 28.055 mg. KOH, using phenolphthalein as indicator). Blanks must be made in each series of tests in order to keep check on the titer of alcoholic alkali in comparison with the N/2 HCl.

(d) The "ester number" is the number of milligrams of potassium hydroxide which are necessary for the saponification of the esters present in 1 gm. of ethereal oil, fat or balsam. The amounts should be weighed accurately. The ester number is therefore the difference between saponification and acid numbers.

Determination of the ester number is carried out as specified in each individual case.

(e) For determination of unsaponifiable matter in oils, the following method is used:

Ten gm. of oil are saponified with 5 gm. of potassium hydroxide and 60 cc. of alcohol, the soap solution is diluted with 60 cc. of water and extracted three times with 30 cc. of petroleum ether. The petroleum ether solution, washed with water, is evaporated and the residue is saponified again with alcoholic potassium hydroxide, the soap solution diluted with water and extracted with petroleum ether. The petroleum ether after shaking with calcium sulphate solution, to remove the last traces of soap, is evaporated and the residue dried and weighed.

32. The iodine number indicates how many parts of iodine are equivalent to the amount of bromine absorbed by 100 parts of fat or oil, determined by the following method:

Fats or oils with a probable iodine number of 200–150, –0.15 gm. to 2 gm., 150–100, 0.2–0.3 gm. and 100–50, 0.3–0.6 gm. and 50–20, 0.6 gm.–1.0 gm. and with smaller iodine numbers, 1 gm. to 2 gm. are placed in a 200 cc. bottle with a tightly ground glass stopper, further sealed by anointing with concentrated phosphoric acid. The oil or the fat is dissolved with 10 cc. of carbon tetrachloride, if necessary, under gentle heating. The quantities should be weighed accurately. Through a pipette 50 cc. of a N/10 potassium bromate solution are added, 1 gm. of coarsely powdered potassium bromide and 10 cc. of dilute

hydrochloric acid, closing the bottle quickly and shaking vigorously until the potassium bromide is completely in solution. The mixture is allowed to stand in the dark for two hours, being shaken frequently during the first hour. The reaction is usually finished; for drying oils or blubbers, 20 hours are required. Carefully opening the bottle, exactly 10 cc. of about N/2 sodium arsenite solution are added, shake well until decoloration has occurred, when 20 cc. of fuming hydrochloric acid are added and the liquid titrated, with agitation, with N/10 potassium bromate solution, until a faint yellow appears. The titration should be carried out in transmitted bright daylight before a sheet of white paper placed immediately behind the flask or the bottle.

If the titration is performed in poor daylight or in artificial light, two drops of indigo-carmine solution are added to the discolored acid solution and titrated under vigorous shaking with a N/10 potassium bromate solution to decoloration, using a white paper as background. As soon as the solution turns pale, another drop of the indicator is added; the reaction mixture is shaken several times, toward the end of the titration before any further addition drop by drop of the potassium bromate solution should be made.

In each series of experiments several blanks should be run in order to check the titer of the N/2 sodium arsenite against the N/10 potassium bromate, in such a way that 10 cc. of carbon tetrachloride, 25 cc. of N/10 potassium bromate solution, 25 cc. water and 1 gm. of powdered potassium bromide and 10 cc. of dilute hydrochloric acid are allowed to act upon each other in the dark in the above-mentioned way in the same period of time; then by pipette 10 cc. of N/2 sodium arsenite and 20 cc. of fuming hydrochloric acid are added and titrated with a N/10 potassium bromate solution. The iodine number (iodine bromine number) is calculated according to the following formula:

$\frac{(a-b).\ 1.2692}{f}$ in which a is the cc. of N/10 potassium bromate solution (50 cc. used for the determination of the iodine of the fat or oil plus the number of cc. added by the titration; b the cc. of N/10 potassium bromate solution used in the blank (25 cc. plus the cc. added by titration), and f represents the amount of fat in grams.

Care should be taken that the amount of bromine absorbed by the fat and that not absorbed should be nearly equal, that is (a–b), should be approximately twenty-five. If this is not the case, at least

for the higher iodine numbers, the determination should be repeated, using correspondingly larger or smaller quantities of fat or oil.

As in these determinations, the slightest experimental error influences greatly the result extremely careful technic and working and operating in duplicate are essential.

33. Determination of the alcohol number in tinctures and detection of methanol and acetone are carried out thus:

To determine the *"alcohol number"* in tinctures, the apparatus described under (29 b) for the determination of the boiling point with the flask A_2 and the attached condenser can be used. The lower portion of the condenser is connected with an adapter, the upper part of which has a diameter of 1.3 cm. is 2.50 cm. long, while the lower part with a diameter 0.5 cm. is 15 cm. long and is connected in such a way that the descending part of the adapter is vertical. In order to facilitate boiling, some small pieces of glass are placed into the flask. As a receiver, a 25 cc. glass cylinder, graduated to 1/10 of a cc., is used.

If not otherwise specified, a mixture of 10 gm. of the tincture to be tested and 5 gm. of water is placed in the flask. The asbestos gauze is heated by means of a small flame placed to one side of the center, so that the wire gauze in the center of the asbestos plate becomes entirely red hot. When the boiling begins, the flame is to be regulated so that the liquid boils vigorously and uniformly. For tinctures prepared with dilute ethyl alcohol about 11 cc. should be distilled, while those prepared with pure ethyl alcohol 13 cc., and with *tinctura opii crocata* and tinctura opii simplex about 9 cc.

The distillate collected is shaken vigorously with so much potassium carbonate that a layer of at least 0.5 cm. high remains undissolved. Tinctures prepared with dilute ethyl alcohol require about 6–7 gm.; opium tinctures require still more and tinctures prepared with pure ethyl alcohol require about 3–4 gm. of potassium carbonate. If too much potassium carbonate is added, no sharp separation occurs. In this case a few drops of water should be added and the mixture shaken until on standing sharp separation takes place.

After cooling to 20° C. by immersion in water of 20° C. for one-half an hour, the number of cc. of the upper alcoholic layer is read, which is the *"alcohol number."*

By multiplying the "alcohol number" with 7.43, the alcohol content in per cent. by weight is obtained for tinctures which have been prepared with absolute ethyl alcohol, or ordinary ethyl alcohol or ethyl alcohol and water.

To test for methanol alcohol and acetone the alcoholic layer obtained in the determination of the "alcoholic number" is subjected again to distillation in the same apparatus. The first 2 cc. of this distillate are used for the following tests:

(a) *Test for Methylalcohol.*

One cc. of this distillate is mixed with 4 cc. of dilute sulphuric acid. To this mixture, after thorough cooling and continuous shaking, 1 gm. of finely powdered potassium permanganate is added. As soon as the purple color has disappeared, it is filtered through a small, dry filter and the faintly red filtrate gently heated for a few seconds until it becomes colorless. After cooling, 3–5 drops of this liquid are added with a pipetteto 0.5 cc. of a freshly prepared and well-cooled solution of 0.02 gm. of guaiacol in 10 cc. of sulphuric acid, of which 0.5 cc. are placed on a watch glass resting upon a white background, whereby the tip of the pipette is brought as closely as possible to the surface of the guaiacol solution. Within two minutes no pink color should appear. (Pink color indicates methanol.)

(a) *Test for Acetone.*

To the other cc. of the distillate, 1 cc. of sodium hydroxide and 5 drops of sodium nitroprusside solution are added. No red that on addition of dilute acetic acid turns purple should appear (indicates presence of acetone or crude "wood spirit").

34. The testing of glasses for drugs for internal use and for drugs which are given by injections should be done in the following way:

(a) *Drug Glasses.*

The drug glasses are filled three-fourths full with an aqueous liquid which contains in 1000 cc., 1 cc. of N/10 hydrochloric acid and 5 drops of methyl red solution, and are heated for one-half hour in a boiling water bath. After this period of time the red color of the liquid should not have completely disappeared.

(b) *Ampul Glasses for Solutions of Alkaloid Salts.*

Five gm. of the coarsely powdered ampul glass are heated for one-half hour with 100 cc. of water, 0.3 cc. of N/100 hydrochloric acid and one drop of methyl red solution in a flask of hard (?) glass which has previously been cleaned by boiling with distilled water. After this period of time the red color of the liquid should not have completely disappeared.

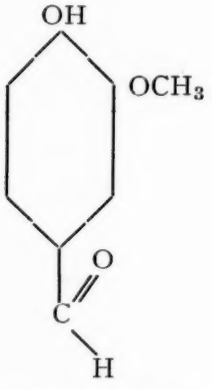
A COMPARATIVE STUDY OF METHYL AND ETHYL PROTOCATECHUIC ALDEHYDE

By Lyell Klotz

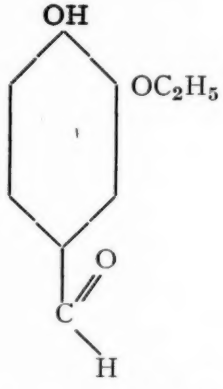
METHYL PROTOCATECHUIC aldehyde or vanillin is a compound commonly used in flavoring extracts. Although it is widely known, comparatively little has been accomplished with the chemistry of its color reactions. Similarly, practically nothing has been published upon the color reactions of ethyl protocatechuic aldehyde.

Vanillin was first extracted from the vanilla bean, in which it is present to the extent of about 2 per cent. It was first synthesized by Tiemann in 1875. Since that time many modifications have been made upon the original process, *i. e.*, oxidation of eugenol to vanillin. Other methods for its manufacture are: 1. Reaction of guaiacol with phenylhydroxylaminesulphonic acid in the presence of formaldehyde; 2. Conversion of eugenol to iso-eugenol and its subsequent oxidation to vanillin; 3. Direct oxidation of iso-eugenol to vanillin by means of ozone. Ethyl protocatechuic aldehyde is sold under several trade names. It is manufactured from pyrocatechuic monoethyl ether by the Reimer-Tiemann reaction, and from benzolsulfoprotocatechuic aldehyde by alkyl halide substitution.

Since there is so much structural similarity between the two compounds:



Methyl protocatechuic aldehyde



Ethyl protocatechuic aldehyde

one would assume that they would show some similarity in their reactions to the various tests. With this end in view, a comparison was made of the color reactions of the two compounds. The following were chosen as the most outstanding tests:

Buard's Indol test.....*Compt. Rend. Biol.* (1908)
Lind's test .....*Ztschr. wiss Mikroskop* 495 (1885)
Ferric Chloride test.....*U. S. Pharmacopœia X*
Lead Acetate test.....*U. S. Pharmacopœia X*
Bohrisch Camphor test.....
Friese Formaldehyde test...*Sudd. Apoth. Ztg.* 752 (1907)
Allen's test for Acetone.....*Allen*
Thalleioquin .....
Modified Thalleioquin .....*Hargreaves, A. Ph. A. Jour.* (Vol. XV, 2 (1926)
Jolle's test for Pentosans....
Grofe's test for Wood Fiber. *Osterreich Botan. Ztschr.* (1905)
Raikow's test for Chlorine..*Chem. Ztg.* 22-20

Experimental

Buard's Indol test.

The test is originally a test for indol in bacteriological cultures and depends upon the addition of a .02 per cent. solution (alcoholic) of vanillin for the development of a rose red color in the presence of HCl.

This test was run upon 1 drop alcoholic solution of indol in 16 drops HCl and as a result it was found that both solutions developed a dark red color with ethyl vanillin a shade the darker.

Lind's test.

This test depends upon the apparent color at the treatment of vanillin with phloroglucin and HCl.

The test was run upon 1-100 solutions of vanillin and ethyl vanillin using 2 cc. of solution and a solution of 1 gm. of phloroglucin in 50 cc. HCl. One drop of the phloroglucin solution was added to 2 cc. of each of the compounds and no change resulted. Upon the addition of 30 drops, the vanillin solution was a reddish-pink while the ethyl vanillin was a light pink. Upon the application of heat both solutions turned to a rose red color.

Ferric Chloride test.

This test is found in the U. S. P. X and is usually used for the detection of phenolic groups.

2 cc. of vanillin and 2 cc. of ethyl vanillin (1-100) were treated with ferric chloride test solution and as a result vanillin gave a dark blue coloration while ethyl vanillin gave a medium greenish tint.

Lead Acetate test.

This is also a U. S. P. test for the detection of vanillin and it depends upon the addition of a small quantity of lead acetate solution to form a ppt. of lead vanillate.

With 1 drop of T. S. upon 2 cc. vanillin and ethyl vanillin (1-100), vanillin produced a heavy white ppt. while ethyl vanillin showed only a white turbidity.

Bohrisch test.

This test depends upon the production of color upon the addition of camphor in HCl to a solution of vanillin.

Dissolve .5 gms. camphor in HCl and 10 drops of this solution is added to 2 cc. of solutions of vanillin and ethyl vanillin (1-100). Vanillin exhibited a dark blue green color and ethyl vanillin was a shade darker although the color was similar in quality.

Friese test.

Shake 5 cc. of milk containing traces of formaldehyde with 10 cc. HCl, a particle of phloroglucin and a 1 per cent. solution of vanillin. A dark blue color is produced.

This test was conducted upon milk, using both solutions of vanillin and ethyl vanillin and no difference could be detected in the colors produced.

Allen's test.

Allen adds a mixture of equal parts of HCl and sulfuric acid to a liquid containing traces of acetone. A 1 per cent. solution of vanillin is added and a dark blue color is produced.

This test was repeated with vanillin and ethyl vanillin and no difference could be detected in the color produced.

Thalleioquin Reaction.

This reaction depends upon the production of a green color when solutions of quinine salts are treated with chlorine water and then with an excess of 10 per cent. ammonium hydroxide. In this connection it was found that vanillin will give a positive test with this reaction although the mechanism of the reaction is open to question.

The test was carried out upon 2 cc. of (1-100) solutions of vanillin and ethyl vanillin, using 10 drops chlorine water and an excess of alkali. Vanillin showed a green coloration while ethyl vanillin was a yellow green color.

Modified Thalleioquin.

This reaction is essentially the same as the preceding reaction, except that bromine water is used in place of chlorine water and a 2 per cent. solution of phenyl hydrazine is added before the addition of the alkali.

The reaction was carried out upon 1-100 solutions of vanillin and ethyl vanillin and as a result vanillin gave a deep yellow brown color while ethyl vanillin gave an orange coloration.

Jolle's test for Pentosans.

The osazone of levulose in the cold with vanillin and HCl will produce a red coloration.

The osazone of levulose was prepared and the solutions of vanillin and ethyl vanillin were tested in the cold with the addition of HCl. It was found that there was no appreciable difference in the red color produced.

Grofe's test for Wood Fiber.

Wood fiber when moistened with vanillin in solution in iso-butyl alcohol and sulfuric acid turns a blue to blue green.

This test was conducted and repeated using ethyl vanillin in place of vanillin and the yellow green color produced showed no variation with the two solutions.

Raikow's test for Chlorine in Benzoic Acid.

Dissolve 1 gm. vanillin and 1 gm. phloroglucin in the same solution. Evaporate .5 gm. of this solution to dryness and place the residue over a sample of benzoic acid which is being heated. If chlorine is present, a red color develops in the residue.

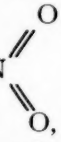
Vanillin and ethyl vanillin both give positive results in this instance although the color produced by vanillin seems to be the more intense.

Interpretation of Results

From the above results, one will see that the reactions are due to either the hydroxy or the aldehyde groups in every case. In substantiation of fact, a number of tests were run on related compounds, and it was concluded that compounds containing these groups in the

proper positions would give similar color tests if the color was not destroyed by other groups. p-hydroxy benzaldehyde was taken as an example and it was found that positive results were obtained in all the vanillin reactions. From these results it was concluded that, in every case, the group occupying the meta- position in the homologues of vanillin has little effect upon the color reactions of the compound and the actual color reactions of vanillin and ethyl vanillin are therefore independent of the differing substituent group.

In support of this conclusion it is interesting to note some of the points in Witt's [1] color theory and their application to the theory suggested to account for the similarity between the color reactions of vanillin and ethyl vanillin.

Witt supposes color to be due to certain chromophoric groups such as C=C, C=N, N=N, N=O,  etc. When several of these chromophores are included in a molecule to form a colorless compound they are called chromogens or chromogenic molecules, and upon the addition of certain other groups called auxochromes, the color is brought out in the chromogen. Now, it will be seen that vanillin and ethyl vanillin have in their molecules the same number of chromophores and since neither is colored they may be thought of as chromogens. Now, these chromogens are colorless, but upon the addition of an auxochrome such as phloroglucin (Lind's test) a red color is produced. Since the group occupying the meta- position is not concerned in the reaction it is further proof that the supposition as to lack of difference between the two compounds is correct.

Dr. G. N. Lewis,[2] of the University of California, supposes color to be due to the interference of the atomic vibration rates in the molecule with certain vibrations as shown by the various colored rays of light, *e. g.*, red light striking a molecule whose atoms are vibrating at the same speed as the light itself, is absorbed. Using this theory as a basis, it would be logical to suppose that since methoxy and ethoxy are very similar groups held under similar restraints and constraints in each case, they would under the influence of different reactions scarcely vary in the uniformity of their absorption spectra.

[1] Witt, *Berichte* **9**, *522* (1876); **21**, *325* (1888).
[2] Lewis, *Jour. Am. Chem. Society*, **38**, *783* (1916).

Summary

1. Vanillin and ethyl vanillin exhibit marked similarity of color reaction in every instance.

2. Every test for vanillin which was used in the experiments herein listed can be used as tests for the detection of ethyl vanillin.

3. Substituted groups in the meta- position have little or no effect on the color reactions of the homologues of vanillin.

4. Reasons for the color changes of these compounds interpreted according to the theories of Witt and Lewis.

College of Pharmacy,
University of Nebraska.

THE ONE HUNDRED AND SEVENTH ANNUAL COMMENCEMENT

of the

PHILADELPHIA COLLEGE OF PHARMACY AND SCIENCE

THE ANNUAL commencement exercises were held on Wednesday, June 5th, at eight P. M., in the Auditorium of the College at 43rd Street, Woodland and Kingsessing Aves., West Philadelphia.

It was a fitting occasion, bringing to a close, a week of intense activities.

Baccalaureate services were held at the Friendly Church at Forty-second and Pine Streets. On Monday evening the Faculty and Board of Trustees had entertained the graduating class at a banquet, served in the College Auditorium.

Tuesday was Alumni Day, well attended and well enjoyed. Athletics, dietetics and other hectic performances had filled the day with pleasure and the dance, of evening, terminated a day of real college entertainment.

Commencement Exercises held on Wednesday evening brought an unsual crowd. The large auditorium of the College was overcrowded, even standing room being at a premium.

After the academic procession over the campus of the College had been concluded the exercises were opened with invocation by Rev. James R. Clinton.

Honorary degrees (Ph. M. *Honoris Causa*) were conferred upon Frederich W. Haussman, a prominent retail pharmacist of Philadelphia, upon Robert S. Sherwin, of Newark, N. J., an active retail pharmacist and a valued worker in the College management, upon Professor Charles Vanderkleed, of Philadelphia—and upon Waldeman Bruce Phillips, a nationally known worker in the ranks of Pharmacy.

The Graduation Address was delivered by Professor Frank Aydelotte, President of Swarthmore College, an able scholar and a splendid speaker. He conveyed to the College the greetings of the great institution he has under his charge, and his message to the student body was of high order and quite typical of the broad-minded, learned gentleman who presented it.

Degrees were conferred by President Wilmer Krusen upon the following groups of candidates who were presented to him by Deans LaWall and Sturmer.

Music for the occasion, and a high class of music it was, was provided by a group of former graduates of the College.

Master of Science in Chemistry

Goeller, George M. ..... New Jersey

Bachelor of Science in Chemistry

Brockman, Frank G. ..... Pennsylvania
Cohen, Charles Anschel ..... Pennsylvania
Deans, Robert Disbrow ..... Pennsylvania
Herbert, William Joseph ..... Pennsylvania
Peters, Earl W. ..... New Jersey
Weiss, James E. ..... Pennsylvania
Wieseman, Paul C. ..... Pennsylvania
Wolf, John ..... Pennsylvania

Bachelor of Science in Pharmacy

Aldenderfer, Samuel McKee ..... Pennsylvania
Brown, Elizabeth Ruth ..... North Dakota
Riesch, Leonard C. ..... Pennsylvania
Voetter, Armin George ..... New Jersey

Bachelor of Science in Bacteriology

Pressman, Ralph ..... Pennsylvania
Price, Samuel R. ..... Pennsylvania

PHARMACEUTICAL CHEMISTRY

Filler, Harry M. ..... Pennsylvania
Schindel, David P. ..... Maryland

GRADUATED WITH THE DEGREE OF PH. G.

Arthur Abendschein ..... New Jersey
Ernest Calhoun Ade .... New Jersey
Solomon Auerbach ..... Pennsylvania
Edgar Stock Auker .... Pennsylvania
John Bartone ..... Pennsylvania
Ithzok Basherglick ..... Pennsylvania
Samuel Bazrod ..... Pennsylvania
Abe Blinderman ..... Pennsylvania
Abraham Bradin ..... Pennsylvania
Joseph Brenner ..... Pennsylvania
Samuel Brenner ..... Pennsylvania
Herbert David Brown ... New Jersey
Herman Miller Brown .. Pennsylvania
Theodore Budin ..... Pennsylvania
John T. Burket ..... Pennsylvania
Kline Maurice Bush .... Pennsylvania
Patrick Francis Caffrey .. Pennsylvania
Webster Bill Canning .. Pennsylvania
Salvatore L. Castaldi ... Pennsylvania
Eugene Robert Cattéau .. Pennsylvania
Vera C. Cianfrogna .... Pennsylvania
Mariana Davis Clark ... Pennsylvania
Robert Maberry Clem .. Pennsylvania
Anthony M. Colarusso .. Pennsylvania
Joseph A. Connelly ..... Pennsylvania
Patrick John Coxe ..... Pennsylvania
Chas. Leroy Crunkleton .. Maryland
Lorain Walton Cuthbert. Pennsylvania
Carlton Elias Cutler ... Pennsylvania
Mildred M. D'Agostino .. New Jersey
Boyd R. Dodson ..... Pennsylvania
Sol Paul Dorman ..... Pennsylvania
Ben Dzubow ..... Pennsylvania
Mabelle Marion Eckels .. Pennsylvania
Ralph Raphael Epstein .. Pennsylvania
Charles Fine ..... Pennsylvania
Isador Edward Fine .... Pennsylvania
Albert Daniel Finzimer .. Pennsylvania
Howard R. Flagler, Jr... Pennsylvania
Margaret M. Flanagan .. Pennsylvania
Morris Fleishman ..... Pennsylvania
George Fred. Fletcher .. Pennsylvania
Harold Edgar Fortiner .. New Jersey
Alfred Edw. Friedman .. New Jersey
John Luther Garland ... Pennsylvania
Vincent Henry Gattone .. Pennsylvania
Harold Godfrey ..... New Jersey
Howard Gold ..... New Jersey
Benj. Harry Goldstein .. Pennsylvania
William Geo. Graver ... Pennsylvania
Kenneth Elijah Greenly. Pennsylvania
Harry Guralnick ..... Pennsylvania
David Hauser ..... Pennsylvania
Harry Norman Hazel .. Pennsylvania
Harold Gooden Heritage . New Jersey
Clement Ferd. Heverly .. Pennsylvania
Josiah Rodda Hosken .. Pennsylvania
Harry Isdaner ..... Pennsylvania
Raymond Jacobson ..... Pennsylvania
Ralph Donald Johnson .. Pennsylvania
Nellie Keen ..... Pennsylvania
Edward Fox Kerman ... Pennsylvania
Leon Kessler ..... Pennsylvania
Paul Hendricks Kline .. Pennsylvania
Vincent Theo. Kostos .. Pennsylvania
Joseph Francis Kovach .. Pennsylvania
Rudolph Stephen Krna .. New York
Charles Kropp ..... Pennsylvania
Isadore Kurland ..... New Jersey
Morris Kushner ..... Pennsylvania
Jacob Frank Leabman .. Pennsylvania
Benjamin Learner ..... New Jersey
Paul Burnel Lecrone ... Pennsylvania
Samuel Lesitsky ..... Pennsylvania
Benjamin Levin ..... Pennsylvania
Sol Jacob Levy ..... New Jersey
Bernard Litwin ..... Pennsylvania
Edm. H. MacLaughlin .. Pennsylvania
John Joseph Mahon .... Pennsylvania
William Arnold Malone .. New Jersey
Dominic M. Manganiello. Pennsylvania
Max Markizon ..... Pennsylvania

Jack Marks .....Pennsylvania
Jos. E. Mathewson, Jr...Pennsylvania
James C. McCluggage..Pennsylvania
Charles Jos. McCollum..Pennsylvania
Claude D. Metzler, Jr. ..Pennsylvania
Nicholas A. Mobilio ....Pennsylvania
Morris Benj. Moses ....Pennsylvania
Thomas Paul Murphy ..Pennsylvania
John Howard Myers ...Pennsylvania
Samuel Myers .....Pennsylvania
Earl Ossar .....Pennsylvania
Fernley Brown Palmer..Pennsylvania
Alfred C. Pawloski ....Pennsylvania
Poague Rowan Paxton..Pennsylvania
William Pepper .....Pennsylvania
Allen Fred. Peters .....Pennsylvania
Philip John Picollo ....Pennsylvania
Morris H. Polonsky ....Pennsylvania
Armand F. Pomendale..Pennsylvania
Theodore Arthur Powl..Pennsylvania
Edward Rabinovitz .....Pennsylvania
Morris Rabinovitz .....Pennsylvania
William Ravitz .....Pennsylvania
Anthony F. Reidinger ..Pennsylvania
Ambrose Eugene Renn ..New Jersey
Edgar Jacob Roberts ...Pennsylvania
Angelo Nicholas Rosa ..Pennsylvania
Louis Wm. Rosenfield ...New Jersey
James Davis Ross .....Pennsylvania
Arthur Milton Rubart ..New Jersey
Gaetano Sambuco .....Pennsylvania
George Wm. Sample, Jr..Pennsylvania
Harry John Samuels ....Pennsylvania
Robert Albert Sandt ...Pennsylvania
Michael A. Santucci ....Pennsylvania
Americus J. Scarani ....New Jersey
Frederick Robt. Schrey..Pennsylvania
Mary Louise Searl .....Pennsylvania
Anthony A. Selvagn ....Pennsylvania
Kenneth Jos. Sheerin ....New Jersey
Ned Fulton Shope .....Pennsylvania
Edward Sica .....Pennsylvania
Edwin F. Sigmund .....Pennsylvania
Al. Silver .....Pennsylvania
Frank Joseph Sitko ....Pennsylvania
Charles Henry Smith ...Maryland
George A. Smith .....Pennsylvania
Paul Kenneth Smith ....Pennsylvania
Solomon Sonstein .....Pennsylvania
Harry Steinhouse .....Pennsylvania
Samuel Joseph Tancredi..Pennsylvania
James Edwin Thomas ...Pennsylvania
Walter Olewine Thomas..Pennsylvania
Linwood F. Tice .....New Jersey
Joseph Jas. Todisco ....Pennsylvania
James Jos. Tomasso ....Pennsylvania
Franklin Wm. Treidler..Pennsylvania
Warren Lee Tremaine...New Jersey
Eugene H. Turner .....New Jersey
Domingo Villalaz A. ...Panama
Frank Xavier Wallace..Pennsylvania
Andrew Henry Walsh ..Pennsylvania
Morgan Newton Walsh..Wash., D. C.
Donald L. Walter .....Pennsylvania
John Wm. Widmann ....Pennsylvania
Melvin A. Widmann ..Pennsylvania
Walter Bruce Wilson ...Pennsylvania
Alfred W. Wood, Jr. ...Maryland
Joseph M. Wujcik .....New Jersey
Harry Vincent Yorke ..Pennsylvania
Benj. Dyke Yorwarth ..Pennsylvania

CANDIDATES WHO HAVE COMPLETED SPECIAL COURSES AND QUALIFIED FOR CERTIFICATES

(This does not include students who completed courses in these subjects for credits for a degree)

In Bacteriology

Connolly, Nan Marie ...Pennsylvania
Fry, Russell E. .....Pennsylvania
Green, Martin I. .....Pennsylvania
Henni, Frederick W. ...Pennsylvania
Hindley, Irene Gertrude..New Jersey
Ichelson, Rachel .....Pennsylvania
Sobel, Julius .....Pennsylvania

IN CLINICAL CHEMISTRY

Davis-Smetana, Irma A..New Jersey
Fry, Russell E. .....Pennsylvania
Green, Martin I. .....Pennsylvania
Henni, Frederick W. ...Pennsylvania
Hindley, Irene Gertrude..New Jersey
Madres, Maxwell E. ....Pennsylvania
Sobel, Julius .....Pennsylvania

IN PHYSIOLOGICAL ASSAYING

Brown, Henry B. .....Pennsylvania
Grobman, Frank H. ....Pennsylvania

AWARD OF PRIZES 1929

GRADUATES IN PHARMACY (Ph. G.)

Designated as "Distinguished"

With General Average of not less than 90%

Angelo Nicholas Rosa
Linwood Franklin Tice

Designated as "Meritorious"

With General Average between 85% and 90%

John Bartone
Abraham Bradin
Theodore Budin
Howard Gold
Josiah Rodda Hosken
Vincent Theodore Kostos
Edmund Herman McLaughlin
Edward Rabinovitz
Morris Rabinovitz
Fredrick Robert Schrey
Edwin Franklin Sigmund
Al Silver
Samuel Joseph Tancredi

The PROCTOR PRIZE, a gold medal for the highest average of the class, is awarded to:

ANGELO NICHOLAS ROSA

The WILLIAM B. WEBB MEMORIAL PRIZE, twenty dollars and a bronze medal for the highest general average in the branches of Operative Pharmacy, Analytical Chemistry and Pharmacognosy, is awarded to:

EDMUND HERMAN MACLAUGHLIN

With Honorable Mention to:

John Bartone
Abraham Bradin
Josiah Rodda Hosken
Angelo Nicholas Rosa
Frederick Robert Schrey
Edwin Franklin Sigmund
Linwood Franklin Tice

The FRANK GIBBS RYAN PRIZE, a gold medal endowed by the Class of 1884, as a memorial to their distinguished classmate, for the best average in the Chemical and Pharmaceutical Laboratory Courses, is awarded to:

LINWOOD FRANKLIN TICE

With Honorable Mention to:

John Bartone
Abraham Bradin
Edmund Herman MacLaughlin
Angelo Nicholas Rosa
Frederick Robert Schrey
Edwin Franklin Sigmund
Samuel Joseph Tancredi

The REMINGTON MEMORIAL PRIZE, $20.00, offered by the Estate of Joseph P. Remington, for the highest general average in the examinations of Operative Pharmacy and Dispensing, is awarded to:

EDWIN FRANKLIN SIGMUND

With Honorable Mention to:

Abraham Bradin
Edmund Herman MacLaughln
Edward Rabinovitz
Frederick Robert Schrey
Linwood Franklin Tice

The MAHLON N. KLINE THEORETICAL PHARMACY PRIZE, a Troemner Agate Prescription Balance, offered by the Mahlon N. Kline Estate, for the highest average in Theory and Practice of Pharmacy, is awarded to:

ANGELO NICHOLAS ROSA

With Honorable Mention to:

Abraham Bradin
Vincent Theodore Kostos
Linwood Franklin Tice

The MAISCH BOTANY PRIZE, $20.00 in gold, offered by Joseph Jacobs, Ph. G., Phar. D., D. Sc., of Atlanta, Ga., to the member of any graduating class who shall have presented the best herbarium collection, or the best thesis on the microscopical structure of one of our medicinal plants, is awarded to:

EDMUND HERMAN MACLAUGHLIN

The BACTERIOLOGY PRIZE, $25.00, offered by the H. K. Mulford Company to the candidate for graduation making the highest general

average and the highest grade on a special examination, in Bacteriology and Serum Therapy, is awarded to:

SAMUEL R. PRICE

With Honorable Mention to:

Abraham Bradin — Samuel Joseph Tancredi
Ralph Pressman — Linwood Franklin Tice
Paul C. Wieseman

Gold Medals awarded by the Alumni Association to the student of the Ph. G. and B. Sc. Graduating Class who attains to the highest scholastic average, are awarded to:

For Ph. G.—ANGELO NICHOLAS ROSA
For B. Sc.—LEONARD C. RIESCH

MEDICAL AND PHARMACEUTICAL NOTES

AUTOMATIN, THE HORMONE OF THE HEART-BEAT—Automatin, the hormone of heart-beat, has been obtained in concentrated solution by circulating potassium-free Ringer's solution through the hearts of eels and frogs. This substance can be adsorbed by charcoal, and by magnesium silicate. It is soluble in alcohol, insoluble in ether, passes through an ultra filter, and is thermostable. It is formed from an unknown substance present in the heart, skeletal muscle, and blood by means of the β radiation of potassium, and can be obtained by allowing radioactive radiation to act on extracts containing the mother substance. The nodal tissue of the heart has a special affinity for automatin, and contains it in a higher concentration than other parts of the animal body. Automatin can be traced by its power of restarting pulsations in the frog's heart, after its beats have been stopped in potassium-free Ringer's solution.—*Ned. Tijdschr. Geneeskunde*, 1927, **71** (2) iii.; through *Chem. Abstr.*, 1928, **22**, 975.

CHEMICAL NATURE OF PEPSIN—Pepsin is difficult to investigate chemically because its aqueous solutions are rapidly inactivated by dilution and agitation, and partially also by aeration. The addition of

alcohol or acetone in presence of mineral acids converts pepsin into an insoluble compound from which the enzyme cannot be regenerated. In presence of picric acid or its salts, pepsin becomes more stable. It can be precipitated quantitatively from concentrated solutions, but it is uncertain whether the precipitate is a true compound or merely an adsorption combination. The fact that some precipitates have greater stability and that some reagents render pepsin totally inactive is held to be evidence that true compounds are formed. The solubility of the sodium and barium compounds of pepsin may indicate that salts are formed with the acid groups in the pepsin molecule. The digestive capacity of pepsin was found to be the same as the milk coagulating power. There is also evidence that pepsin consists of an inactive fraction and a kinase.—Helena Elbonger and C. Funk (*Biochem. Zeit.*, 1927, **191**, 186; through *Chem. Abstr.*, 1928, **22**, 1371; through *Pharm. Jour.*)

Poisoning with Thallium Acetate—The report from London of fatalities due to accidental overdosage with thallium acetate is worthy of comment.

It appears that a young woman dispenser in compounding a prescription containing this drug, had occasion to convert the quantity ordered from the metric system of weights to the Imperial system, and in doing so mistook the position of the decimal point. As a result, the medicine contained ten times the prescribed quantity of the drug, and three children were poisoned.

The jury returned a verdict of death from poison accidentally administered.

This is by no means the first case in which an error has been made either in the careless and incorrect placing of the decimal point or in the misinterpretation of a correctly-placed point, and it calls for some consideration of the so-called advantages of the decimal system.

That this system is useful in its application to many scientific operations may be claimed without fear of contradiction, but it must be recognised that prescribing and compounding are not, as yet, sciences, but very special arts, and come in a different category.

A misposition, or a misinterpretation of the position, of the decimal point in the laboratory is soon discovered and readily corrected

after titration or other procedure, but such a mistake at the bedside cannot be rectified, and may cost a valuable life.

The multiplicity of weights in the metric system—milli, centi, deci grammes, etc.—is a great disadvantage as compared with the Imperial, where, for practical purposes, one has to consider only grains, and rarely ounces.

Such a paucity of standards facilitates the memorisation of doses, allows of a clearer mental conception of quantities, and minimises the possibility of error.

Though both are official, and in academic spheres both are used, the physician, almost without exception, adopts the Imperial system for workaday use, after he has satisfied the examiners that he is conversant with both. Can it be that physicians are all unscientific and are in conspiracy to ban the metric system, or is it because they recognise the safety and utility of the Imperial system in this special sphere?

However, both systems being with us, it is incumbent on prescriber and dispenser alike to minimise the possibility of error by avoiding the decimal point, quantities being written, not in fractions of a gramme, but in milli, centi, or deci grammes; by avoiding the necessity of conversion from one system to another, the standard weights and measures in both systems being kept in everyday use; and by a careful checking of quantities prescribed with reference to dosage tables setting out the limits of therapeutic safety where such is not definitely known by personal experience.

Of special interest, in this case, is the jury's finding, which was the outcome of an exhaustive inquiry involving, inter alia, the testing of the dispenser's capacity to convert weights and measures from one system to another in the presence of the court.

Thallium acetate, the drug involved in this case, is used to effect a falling of the hair in cases of ringworm, the epilation dose (as worked out by Buschke) being 8 milligrammes per kilogramme of body weight, this being administered orally in aqueous solution. In a large percentage of cases the hair begins to loosen by the seventh day, and epilation is complete by the nineteenth day, or, when not completely shed, the hair can be removed with strips of adhesive plaster.

In effective dosage its margin of therapeutic safety is small, a slight excess producing abdominal and joint pains, diarrhœa, albuminuria and drowsiness, resembling the picture of lead poisoning.

In animal experiment, with guinea pigs and rabbits as subjects, a gross degeneration of the tubules of the kidney was the main finding on postmortem examination.—*Austral. Jour. Phar.*

THALLIUM ACETATE: TABLE FOR ESTIMATING DOSAGE *

The increasing use of thallium acetate for epilating the scalp in children suggested the preparation of a handy table for the estimation of the required dose. It is hoped that this will save considerable time and will minimize the possibility of error in calculating the dose for an individual patient. The table is based on the standard dose of 8 mg. of thallium acetate per kilogram of body weight.

Table for Estimating Dosage of Thallium Acetate

Pounds Body Weight	Kilograms Body Weight	Grams Thallium Acetate
¼	0.1134	0.0009
½	0.2268	0.0018
¾	0.3402	0.0027
1	0.4536	0.0036
2	0.9072	0.0073
3	1.3608	0.0109
4	1.8144	0.0145
5	2.2679	0.0181
6	2.7215	0.0218
7	3.1751	0.0254
8	3.6287	0.0290
9	4.0823	0.0327
10	4.5359	0.0363
20	9.0718	0.0726
30	13.6077	0.1089
40	18.1436	0.1451

*From the Department of Dermatology and Syphilology, University and Bellevue Hospital Medical College, Service of Dr. Howard Fox.

Pounds Body Weight	Kilograms Body Weight	Grams Thallium Acetate
50	22.6795	0.1814
60	27.2154	0.2177
70	31.7513	0.2540
80	36.2872	0.2903
90	40.8231	0.3266
100	45.3590	0.3629

Example: Patient weighs 38½ pounds
Dose for 30 pounds = 0.1089
8 pounds = 0.0290
½ pound = 0.0018
Dose for 38½ pounds = 0.1397 gm. of thallium acetate

MARCUS RAYNER CARO, M. D.,
New York.

NICOTINE AFFECTS SECRETION OF MILK.—Large doses of nicotine suppressed the secretion of milk in the cat and the cow and, in one case, in the human mother, investigations carried out by Dr. Robert A. Hatcher and Hilda Crosby of the Cornell University Medical College have revealed. The experiments were undertaken to discover any effects on either mother or child when the nursing mother smoked.

"Little is known concerning the excretion of nicotine in the milk of lactating women who smoke. Our attention was directed to the problem by the occurrence of symptoms in an infant which were thought to be due possibly to nicotine in the milk of the mother who smoked many cigarettes," the authors stated in their report to the *Journal of Pharmacology and Experimental Therapeutics.*

Smoking mothers have recently come in for considerable censure by members of the clergy and other reformers on the ground that smoking injures both mother and nursling. As a matter of fact, no very exact scientific knowledge of the subject is available, except for the recent experiments of Dr. Hatcher and Miss Crosby. Physicians have not found any effect on the child that could be attributed to nicotine poisoning from cigarettes smoked by the mothers. These experi-

ments bear this out. Kittens who nursed from the cat which had received large doses of nicotine were not affected. Dr. Harvey C. Williamson, Dr. Howard S. McCandlish and Dr. Ogden Conkey, all of the department of obstetrics and gynecology of Cornell University Medical College and consequently men of vast experience with mothers and new-born babies, told the investigators verbally that they never had observed and diminution in the secretion or supply of milk, or any effect on a child that could be attributed to smoking of cigarettes by mothers.

Tobacco is known to affect different people in different ways. Some are extremely susceptible to nicotine. Partly because of this but largely because pregnancy is a precarious condition calling for every precaution, physicians generally advise expectant mothers to refrain from smoking. This is done largely to protect the mother herself from any possible ill effects.

In the experiments of Dr. Hatcher and Miss Crosby, it was found that large doses of nicotine suppressed the secretion of milk in cat and cow for longer periods than those required for the elimination of the greater part of the poison from the body. The human subject of the experiment was a young woman aged twenty-five. She smoked from twenty to twenty-five cigarettes a day. The secretion of milk had been abundant but decreased rapidly during the last two days of the experiment. A specimen of the milk was then examined and found to contain just a trace of nicotine.—*Science Service.*

EDITOR'S NOTE: That the foregoing is not an entirely new discovery is attested to by a similar statement appearing in the article "My Lady Nicotine," appearing on page 77 in the February, 1927, issue of this JOURNAL.

TRACES OF NICKEL FOUND IN FOODS—Traces of nickel have been found in several human foods by Prof. Hans Kaufmann and Prof. Oskar Keller, of the Pharmaceutical Institute of the University of Jena. The amounts are expressible only in millionths of a per cent. by weight, but may be of medical significance, since nickel is usually considered an element deleterious to human health, which must be eliminated from the system. However, if minute amounts of certain metals are needed by all animal tissues, as some chemists claim, this may be the source for the body's nickel supply.

The two German chemists were led to their researches by the question of the possible harmfulness of nickel in margarine. This food fat is made by passing hydrogen through vegetable oils, in the presence of finely divided nickel which serves as a catalyst, or chemical matchmaker to secure the union of the hydrogen and the oils. By testing high-grade margarine with the most delicate of known chemical methods, percentages of nickel from five ten-millionths to one millionth by weight were detected.

But when the experimenters turned their attention to butter, they were surprised to find that good grades of this product contained more nickel than was in their margarine samples. They then analyzed various fodders eaten by cows, and again found nickel.

The highest concentrations of nickel in plants were found in the legume, or pea family. Peas and beans showed percentages as high as two hundred-thousandths.—*Science Service.*

MISBRANDED COD LIVER OIL PREPARATIONS BEING REMOVED FROM THE DRUG MARKET—Efforts of the Food, Drug, and Insecticide Administration to remove adulterated and misbranded cod liver oil preparations from the channels of interstate commerce have met with much success, according to the United States Department of Agriculture.

Makers of these preparations in the form of liquids, tablets, capsules, or wafers, claim for them the medicinal qualities of cod liver oil. They claim also that the new extract form is free of the oily, fatty or fishy taste normal to cod liver oil.

Administration specialists report, however, that in most instances such preparations are not only free from the oily portions, but from therapeutic principles as well.

In its extensive survey of articles of this kind on the American market during the past few years, the administration has found that such alleged extracts themselves and the various preparations alleged to contain such extractive principles were devoid of vitamin A and, with very few exceptions, of vitamin D. Both of these vitamins constitute the active therapeutic principles of cod liver oil. Most of the so-called cod liver oil products were found to be illegal, not only as to claims of relationship of the product to cod liver oil or of the content of vitamin A and D, but also because of gross misbranding as to promises of benefits in various disease conditions.

Many of these preparations, including the extracts themselves, have been taken off the market entirely as a result of the quiet non-legal work of the Food, Drug, and Insecticide Administration. The labels on others have been modified in such a way that they no longer suggest any relationship to cod liver oil, and all exaggerated claims have been removed.

One compound sold as a cod liver oil preparation, according to the label, would produce "excellent results in the treatment for chronic rheumatism, tuberculosis, loss of appetite, anemia, rickets, convalescence, neurasthenia and melancholia." This product which was widely advertised and distributed, is now correctly labeled, "A tablet to be used where a tonic is indicated."

While the first general survey of this type of cod liver oil products has been practically completed, there are still on the market some cod liver or cod liver oil preparations which, because of limited facilities of the administration, have not yet received attention.

Work now under way by the administration involves those preparations containing cod liver oil itself, such as emulsions and various flavored cod liver oils. Where such emulsions or oils are found to be deteriorated, misbranded or otherwise having statements violating the Food and Drugs Act, appropriate action will be taken. Many of the emulsions are composite preparations, containing, in addition to cod liver oil, egg, malt, iron, arsenic, and in numerous cases are mixed with expectorants and marketed as cough mixtures.

STRONTIUM THIOACETATE AS AN ANTIDOTE IN POISONING BY MERCURIC CHLORIDE—The announcement by Hesse that strontium thioacetate is capable of neutralizing mercuric chloride in the tissues of experimental animals is of great interest.

Haskell and Forbes, of the Department of Pharmacology and Chemistry, Medical College of Virginia, Richmond, Va., state that although Hesse's work appears to have been carefully controlled, certain conditions suggested to them the desirability of confirming his results by a different method. Hesse used rabbits almost exclusively. They felt that dogs are more suitable experimental animals for an investigation of this nature.

The efficacy of Hesse's antidote was tested on the animals (dogs) after intravenous or oral administration of the poison. Being unable to obtain strontium thioacetate, they prepared it according to directions given by Hesse.

In the first experiments, eight dogs were given varying doses of mercuric chloride intravenously; a freshly prepared 1 per cent. solu-

tion in distilled water being used. Four served as controls; four were treated by intravenous or subcutaneous injection of a 10 per cent. solution of strontium thioacetate in distilled water.

Their results show that strontium thioacetate in dogs receiving large doses of mercuric chloride intravenously has not resulted favorably; indeed, the supposed antidote seems to have shortened the duration of life in every instance.

The great majority of cases of mercurial poisoning among humans are those who have taken it by mouth. In their second series of experiments they tried to determine the efficacy of the antidote on animals who received the poison orally.

Ten dogs were fasted for twenty-four hours. Five of the animals were used as controls; five were treated with strontium thioacetate within fourteen to one hundred and fifty-nine minutes after the administration of the mercuric chloride. Here, again, the supposed antidote failed completely to exert any favorable influence.

The evidence shown in their paper is sufficient to show that strontium thioacetate is practically without value in the treatment of dogs poisoned either by the intravenous or the oral administration of fatal doses of mercuric chloride. They also show that the supposed antidote injected intravenously in a dose of 200 mgm. per kilogram is of itself distinctly injurious to animals suffering from mercurial poisoning; and the marked temporary (?) disturbances shown by normal dogs after such an intravenous dose supports this view.

The authors feel that a much more thorough investigation of the action of strontium thioacetate on lower animals should be carried out before employment of this chemical on human beings.—*Chas. C. Haskell and J. C. Forbes, Journal of Pharmacology and Experimental Therapeutics,* February, 1929, page 147.

J. K. THUM.

THE PHARMACIST IN OPERA. (By George N. Malpass.) The pharmacist has been written about and referred to in many kinds of literature throughout the ages, but music is a realm he has seldom entered. How many of us know that an opera was written about him, by one of the greatest composers of all time?

The comic opera, "The Apothecary," was composed by the old master, Josef Haydn, in the year 1768, when he was thirty-six years of age. It is the best known of Haydn's few attempts at opera. He will be remembered, of course, primarily as the "Father of Modern

Symphony." He wrote in all over one hundred symphonies, not the heavy, stirring type of the more modern works of Beethoven, Brahms, and Tschaikowsky, but the light, short melodious compositions, which were the forerunners of the later four-part symphonies. These compositions, including the well-known Symphony Militaire, and the Surprise Symphony, along with his other works, occupied most of Haydn's time, and left little thought for opera. In fact, he did not care much for opera, as did his pupil and contemporary, Mozart, who wrote many fine operas a few years later. That, perhaps explains the fact that Haydn forgot all about the "Apothecary" after he wrote it, and it was never produced until many years after his death.

After a sleep of 125 years in the dust of Prince Esterhazy's archives at Eisenstadt, Dr. Hirschfeld received permission from Prince Paul Esterhazy, of Galantha, to copy the original manuscript.

It is Dr. Hirschfeld's merit to have revived and rearranged this charming specimen of the old master's genius. And again it was Ernst Schuch, the highly gifted director of the Dresden Opera, who had it represented on that stage in 1895, and at the same time introduced it to the Viennese admirers of old Haydn by some of the best members of his company.

The music is truly Haydnish, simple, fresh and clear, and lends repose and enjoyment to modern ears, accustomed to and tired of the oddities of modern orchestration.

The plot is simple and amusing. A young man, Meningo, has entered the service of the apothecary Sempronio, though he does not possess the slightest knowledge of chemistry. His love for Sempronio's ward Grilletta has induced him to take this step, and in the first scene we see him mixing drugs, and making melancholy reflections on his lot, which has led him to a master who buries himself in his newspapers instead of attending to his business, and letting his apprentices go on as best they may. (Haydn was a prophet as well as a composer, it seems.)

Sempronio, entering, relates that the plague is raging in Russia; and another piece of news, that an old cousin of his has married his young ward, which is far more interesting to him than all his drugs and pills, as he intends to act likewise with Grilletta. The young lady has no fewer than three suitors, one of whom, a rich young coxcomb, named Volpino, enters to order a drug. His real intention is to see Grilletta. He is not slow to see that Meningo loves her too, so he sends him into the drug kitchen, in order to have Grilletta all to him-

self. But the pert young beauty only mocks him, and at Meningo's return, Volpino is obliged to retire.

Alone with Meningo, Grilletta encourages her timid lover, whom she likes very much, but just when he is about to take her hand, Sempronio returns, furious to see them in such intimacy. He sends Meningo to his drugs and the young girl to her account books, while he buries himself once more in the study of his newspapers. Missing a map, he is obliged to leave the room. The young couple improve the situation by making love, and Meningo, growing bolder, kisses Grilletta. Alas, the old man returns at the supreme moment and, full of rage, sends them to their rooms.

Meningo's effrontery ripens the resolution in the guardian's breast to marry Grilletta at once. He is, however, detained by Volpino, who comes to bribe him by an offer from the Sultan to go into Turkey as apothecary at court, war having broken out in that country. The wily young man insinuates that Sempronio will soon grow rich, and offers to give him 10,000 ducats at once if he will give him Grilletta for his wife. Sempronio is quite willing to accept the Sultan's proposal, but not to cede Grilletta, so he sends Meningo away to fetch a notary, who is to marry him to his ward without delay. The maiden is quite sad, and vainly tortures her brain how to rouse her timid lover into action. Sempronio, hearing her sing so sadly, suggests that she wants a husband, and offers her his own worthy person. Grilletta accepts him, hoping to awaken Meningo's jealousy and to rouse him to action. The notary comes, in whom Grilletta at once recognizes Volpino in disguise. He has hardly sat down when a second notary enters, saying that he has been sent by Meningo, and claiming his due. The latter is Meningo himself, and Sempronio, not recognizing the two, bids them sit down. He dictates the marriage contract, in which Grilletta is said to marry Sempronio by her own free will, besides making over her whole fortune to him. This scene, in which the two false notaries distort every word of old Sempronio's, is overwhelmingly comical. When the contract is written, Sempronio takes one copy, Grilletta the other, and the whole fraud is discovered. Volpino vanishes, but Meningo promises Grilletta to do his best in order to win her.

In the last scene, Sempronio receives a letter from Volpino, telling him that the Pasha is to come with a suite of Turks to buy all his medicines at a high price, and to appoint him solemnly as the Sultan's apothecary. Volpino indeed arrives, with his attendants, all disguised

as Turks, but he is again recognized by Grilletta. He offers his gold, and seizes Grilletta's hand, to carry her off, but Sempronio interferes. Then the Turks begin to destroy all the drug pots and glasses and costly medicines, and when Sempronio resents this the false Pasha draws his dagger, but Meningo interferes, and at last induces the frightened old man to promise Grilletta to him if he succeeds in saving him from the Turks. No sooner is the promise written and signed, than Grilletta tears off the Pasha's false beard and reveals Volpino, who retires baffled, while the false Turks drink to the young couple's health at the cost of the two defeated suitors.

CORRESPONDENCE

THE UNITED STATES PHARMACOPŒIAL CONVENTION

ELEVENTH DECENNIAL CONVENTION FOR THE REVISION OF THE PHARMACOPŒIA OF THE UNITED STATES OF AMERICA

1820–1930

REID HUNT, M. D.

240 Longwood Avenue, Boston, Mass.

May 25, 1929

American Journal of Pharmacy
43rd and Kingsessing Avenue
Philadelphia

Gentlemen:

In compliance with the provisions of the Constitution and By-Laws of the United States Pharmacopœial Convention I am issuing a call for the Eleventh Decennial Convention to meet in Washington, D. C., on May 13, 1930.

A copy of this is enclosed and its publication in the current issue of your JOURNAL would be a coöperative service in publicity for the next Pharmaceutical Convention which would be greatly appreciated.

Very truly,

REID HUNT,
President of the United States Pharmacopœial Convention of 1930.

CALL FOR THE

ELEVENTH CONVENTION FOR THE REVISION OF THE PHARMACOPŒIA OF THE UNITED STATES OF AMERICA

UNITED STATES PHARMACOPŒIAL CONVENTION

(INCORPORATED 1900)

BOSTON, MASS., May 25, 1929.

In compliance with the provisions of the Constitution and By-Laws of the United States Pharmacopœial Convention, the President of the Convention hereby invites the several bodies, entitled under the Constitution to representation therein, to appoint delegates to the Eleventh Decennial Convention to meet in Washington, D. C., on May 13, 1930, and the attention of all concerned is invited to the following extract from the Constitution and By-Laws:

CHAPTER I, ARTICLE VIII, of the By-Laws of the United States Pharmacopœial Concention provides that the President of the Convention:

> "shall issue on or about the first of May of the year immediately preceding that of the decennial meeting, a notice inviting the several bodies, entitled under the Constitution to representation therein, to send delegates to the next meeting. He shall repeat the notification eight months later, and shall request the medical and pharmaceutical journals of the United States to publish the call for the said meeting."

ARTICLE II, Section 1, of the Constitution provides:

> "The members of the United States Pharmacopœial Convention, in addition to the Incorporators and their associates, shall be delegates elected by the following organizations in the manner they shall respectively provide: Incorporated Medical Colleges, and Medical Schools connected with Incorporated Colleges and Universities; Incorporated Colleges of Pharmacy, and Pharmaceutical Schools connected with Incorporated Universities; Incorporated State Medical Associations; Incorporated State Pharmaceutical Associations; the American Medical Association, the American Pharmaceutical Association, The American Chemical Society, the National Association of Retail Druggists, and the National Association of Boards of Pharmacy; *provided that no such organization shall be entitled to representation unless it shall have been incorporated within and shall have been in continuous operation in the United States for at least five years before the time fixed for the decennial meeting of this corporation.*"

SECTION 2 of the Constitution provides:

> "Delegates appointed by the Surgeon-General of the United States Army, the Surgeon-General of the United States Navy, and the Surgeon-General of the United States Public Health Service, the Secretary of Agriculture, the Secretary of Commerce, the Association of Official Agricultural Chemists, the Association of American Dairy, Food and Drug Officials, the National Wholesale Druggists' Association, the National Dental Association, the American Drug Manufacturers' Association, the United States Division of Customs, and the University of Havana, and by the organizations not hereinbefore named which were admitted to representation in the Convention of 1900, shall also be members of the corporation. Each body and each branch of the United States Government above mentioned shall be entitled to send three delegates to the meetings of this corporation. But no such delegates as are provided for in this article shall be members until their credentials shall have been examined and acted upon as provided for by the By-Laws. Delegates admitted as members at any decennial meeting shall continue to be members of the United States Pharmacopœial Convention until their successors shall have been appointed and admitted as delegates to the ensuing Convention and no longer."

REID HUNT, M. D.,
President of the United States Pharmacopœial Convention of 1930.

LYMAN F. KEBLER, M. D.,
Secretary of the United States Pharmacopœial Convention of 1930.
1322 Park Road, N. W., Washington, D. C.

NEWS ITEMS AND PERSONAL NOTES

ELMER D. MICHENER, DECEASED—Another of Philadelphia's old school pharmacists has passed to his eternal reward. Elmer D. Michener died on Friday, May 24th, at his home, Twelfth and Huntingdon Streets, Philadelphia, after a very brief illness.

Mr. Michener was an active worker in the ranks of local and state pharmaceutical associations and was at the time of his death president of the Philadelphia Association of Retail Druggists.

His cheerful, unselfish devotion to the interests of his fellow-men had won for him a high station in the regard of his host of friends.

PARKE-DAVIS SCIENTIST RETIRES—Following a noteworthy service of thirty-four years with the house of Parke, Davis & Co., Dr. E. M. Houghton retired from active duty on May 1, but will continue as a member of the company's executive staff, with the title of Consulting Director of the Research and Biological Laboratories.

Dr. Houghton came with Parke, Davis & Company on February 1, 1895, to take charge of research work in pharmacology. He was associated with Dr. Charles T. McClintock as Junior Director of the company's Biological and Research Laboratories from that time until 1910, when Dr. McClintock retired and Dr. Houghton became Director.

Dr. Houghton was graduated from the University of Michigan with the degree of Pharmaceutical Chemist in 1893, and received the degree of Doctor of Medicine from the same institution in 1895. He was Assistant in Pharmacology at the University from 1894 to 1895, immediately prior to joining Parke, Davis & Co.; Lecturer in Pharmacology at the Detroit College of Medicine and Surgery from 1897 to 1902; and was also a special lecturer at the University of Michigan for several years after that. He has been for several years chairman of the Biological Section of the American Drug Manufacturers' Association.

A ROYAL ORDER—An interesting order from Mecca, Arabia, was recently received by the H. K. Mulford Company from the physician attending King Abdel Aziz Ibn Saoud of Hedjaz and Nejd, for Dried Smallpox Vaccine.

The letter accompanying the order stated that the King was always interested in special drugs and biologicals which he could use

in his country, and the Dried Smallpox Vaccine was certainly something of value.

Dried Smallpox Vaccine, as the name implies, is an active virus in powder form, especially suited for use in the tropics and sub-tropics where ordinary glycerinated lymph quickly loses its potency.

The Mulford Laboratories have been working with Dried Smallpox Vaccine for several years, and have had reports from Abyssinia, Sudan, South America, Jamaica, Cuba and China, attesting that this product marks a distinct advance over anything hitherto reported capable of establishing successful vaccination in hot climates.

This Dried Vaccine produced in the Mulford Laboratories, was the first developed on this continent.